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The classification of the finger frames method in violin playing

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The Classification of the *Finger Frames* Method in Violin Playing

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Abstract

From the first stage of learning new repertoire, string pedagogy aims to present violinists with effective strategies to achieve accurate intonation in performance. The search for new teaching and learning strategies, whilst running the risk of being seen as unconventional compared to more tried and tested methods (i.e. Suzuki), can on the other hand provide the tutor with new tools for enhancing their teaching practice. Western Australian violinist Fleur Challen has developed a method titled *Finger Frames*; a learning strategy that uses a colour coding system to prepare a violinist for changes in left hand position, reducing the cognitive load during the process of sight-reading new repertoire. In the field of psychology, research has been undertaken on artificial synaesthesia to indicate that when two particular senses are linked together, it eliminates a stage of processing between them, therefore reducing cognitive load. This research paper aims to document Challen's *Finger Frames* method, and to argue how related research on artificial synaesthesia and Cognitive Load Theory can help to explain why such a system may work. This research involves a qualitative discussion of the *Finger Frames* method with respect to string pedagogy, motor learning and muscle memory, and psychology, and includes an interview with Challen.

Acknowledgements

I would first like to thank my supervisor, Dr Stuart James, for his amazing advice and support through every step in writing this paper. I also want to thank Fleur, for introducing me to her Finger Frames which have become an integral part of my playing, and allowing me to write about her wonderful method. And of course thank you to my family and friends, for their continued support and encouragement in finishing both this paper and this degree!

Abbreviations

m3	Minor third
M3	Major third
T	Tone
S	Semitone

1st, 2nd, 3rd and 4th all refer to a finger of the left hand (as opposed to first, second, third and fourth). See Figure 2.

In the same way, 1, 2, 3, and 4 all refer to a finger of the left hand (as opposed to one, two, three and four).

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Chapter 1. Introduction and Context

1.1. Introduction

The structure of Western Art Music notation can present many overlaying elements of meaning, which can result in visually dense sheet music.[1] For this reason, the instruction presented can be somewhat obscured as the performer has to focus on several layers of meaning simultaneously. The range of symbols used in Western music notation reflects both the technical aspects of music (i.e. structural indications such as bar lines, pitch, rhythm) as well as suggested articulations and expressive qualities that might enhance the musicality of a performance.[2] For this reason performers can struggle to practise in such a way that allows them to quickly organise an approach to performing each individual note within the context of a piece in a musical way. From a pedagogical perspective, the problem with playing well and in tune according to current research, isn't that the musician is lacking in technique or skill,[3] but rather they are reading sheet music that presents too much information for their working memory.[4]

For string players specifically, there are additional un-notated aspects to consider. Spacing of the fingers changes in each *position* (terms in italics are defined in the Glossary), and the fretless fingerboard (see Figure 1 for a labelled diagram of the violin) allows for infinite[5] degrees of freedom in intonation. This fretless structure is both a blessing and a curse as it causes difficulty in intonation. Additionally there are many elements that go into the correct placement of just one note and consequently the following must be considered: the note's relation to preceding and succeeding notes; how to get to the note (i.e. *shifting position*, a string change, an *extension*); what *position* it should be played in; and on what string.

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[1] Tim Halverson and Anthony J. Hornoff, "Explaining Eye Movements in the Visual Search of Varying Density Layouts," (paper presented at the Sixth International Conference on Cognitive Modeling, Pittsburgh, United States of America, June 30—August 1, 2004), 126–127.

[2] Robert G. Petzold, "The Perception of Music Symbols in Music Reading by Normal Children and by Children Gifted Musically," *The Journal Of Experimental Education* 28, no. 4 (1960): 271, accessed October 27, 2016, doi: 10.1080/00220973.1960.11010662.

[3] "Reviews & Articles," accessed April 17, 2016, http://www.playingwithcolour.co.uk/reviews-articles/#04.

[4] Ton de Jong, "Cognitive load theory, educational research, and instructional design," *Instructional Science* 38 (2010): 106, accessed July 7, 2016, doi:10.1007/s11251-009-9110-0.

[5] Dale Jacquette, *David Hume's Critique of Infinity* (Leiden: Brill, 2001), 15, accessed May 8, 2016, https://books.google.com.au/.

This process presents difficulties, particularly for less experienced players, most often when beginning new repertoire, where every note's specific markings and features must be interpreted in real-time.[6] These features, which must undergo translation from layers of written meaning into actions on an instrument, include the pitch, fingerings, bowings, rhythm, dynamics, articulation and tempo. Sight-reading music that contains many of these multi-layered elements can result in cognitive overload[7] which can reduce playing accuracy (explored further in subchapter 1.2).

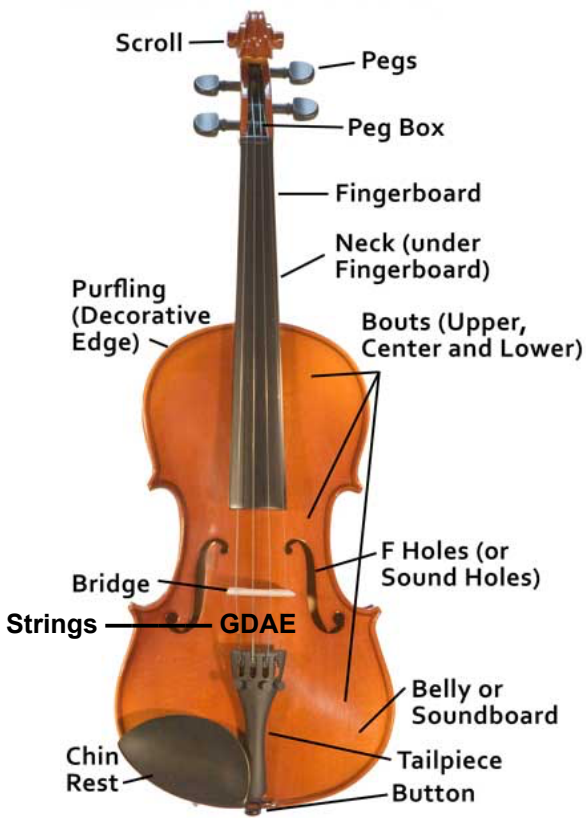

Figure 1. Structure of the violin.[8]

[6] Petzold, "The Perception of Music Symbols in Music Reading by Normal Children and by Children Gifted Musically," 271.

[7] John Sweller, "Cognitive load during problem solving: Effects on learning," *Cognitive Science* 12, no. 2 (1988): 257–285, accessed May 2, 2016, doi:10.1016/0364-0213(88)90023-7.

[8] "Violin/Viola and Bow," accessed October 4, 2016, http://www.lavastrings.com/resources_parts.html.

Finger Frames, a method developed by violinist Fleur Challen,[9] focuses on one aspect of this: creating a method for performing, remembering and deciding on fingerings, by reducing the cognitive load[10] in interpreting pitch in notation. By classifying every note into colour-coded finger patterns it first prevents one from having to constantly check fingerings and semitone placement, and second develops strong visual associations.

Challen was born in Melbourne Australia but grew up and studied in Western Australia. She completed a Bachelor of Music (Hons) at UWA, studying with John Exton and Carmel Kaine, former student of Ivan Galamian who was a tremendous influence. She was twice awarded The Marguerite Bello Prize for Chamber Music and The Vose Prize for solo performance. Immediately after graduating from UWA, Challen took up a position as a First Violin with The West Australian Symphony Orchestra and for many years acted as Principal First Violin, as well as filling in as acting Associate Concertmaster and Concertmaster. She has a great interest in teaching and mentoring and has tutored for AYO and WAYO, and has been a Mentor for the WASO Orchestral Training Program .

This paper will document and discuss Challen's method in detail and provide examples of how to apply her *finger frames* to selected repertoire. The context surrounding this method will be explored, including discourse surrounding the notion of Cognitive Load Theory associated with performance on a string instrument; a brief summary of left hand technique issues; and discussion focusing on the use of artificial synaesthesia to aid systems of learning. Through the qualitative discussion of an interview conducted by the author with Challen, along with research into relevant fields of cognitive psychology, violin performance, and pedagogy, the following questions will be addressed:

1. Can the *Finger Frames* method reduce the cognitive load of sheet music reading in order to promote more effective working memory use?
2. Do *finger frames* address the issues with organising left hand technique in violin playing?

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[9] Fleur Challen, interviewed by the author, September 2016.

[10] Sweller, "Cognitive load during problem solving: Effects on learning," 257–285.

3. Do *finger frames* ultimately lead to more accurate intonation in sight-reading in practice and performance?

1.2. Cognitive Load Theory

Cognitive Load Theory is the widely accepted hypothesis that the 'cognitive capacity in working memory is limited.'[11] This means that a person can only constructively take in and use a certain amount of information before the brain can no longer effectively interpret data.[12] Working memory is the part of the brain that is responsible for processing perceptual information at the outset and when this part of cognition is 'overloaded', mistakes become more likely.[13]

A task's cognitive load can be determined by three main categories. Element interactivity, intrinsic cognitive load, and extraneous cognitive load. Element interactivity is determined by whether a component can be processed as it's own independent unit without any outside interference, or whether other elements must be taken into account simultaneously.[14] Intrinsic cognitive load is how difficult a task is due to it's element interactivity. A high element interactivity results in a high intrinsic cognitive load. This cannot be altered in any way, unless the task itself is modified. Therefore if the task itself cannot be modified, the only way to effectively reduce the cognitive load of a task is to change the way the task is presented, therefore affecting extraneous cognitive load.[15] If the extraneous cognitive load is lowered, the overall cognitive load of a task can be lowered.

This theory can be applied to sight-reading while playing the violin. The reason that playing string instruments specifically has a high cognitive load compared to some other instruments, is because there are multiple ways to play the same note (in some cases there are up to 12 ways to play a single note, see Table 1), and its preceding and succeeding notes influence which option to choose. This means that

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[11] De Jong, "Cognitive load theory, educational research, and instructional design," 105.

[12] De Jong, "Cognitive load theory, educational research, and instructional design," 105.

[13] John Sweller, Paul Ayres, and Slava Kalyuga, *Cognitive Load Theory* (New York: Springer, 2011), accessed July 7, 2016, doi: 10.1007/978-1-4419-8126-4.

[14] John Sweller, "Cognitive Load Theory," *Psychology of Learning and Motivation* 55 (2011): 57, accessed June 23, 2016, doi:10.1016/B978-0-12-387691-1.00002-8.

[15] Sweller, "Cognitive Load Theory," 57.

multiple notes, and their many options must be processed at the same time resulting in high element interactivity and therefore high intrinsic cognitive load.

Table 1 below concisely presents which fingers (see Figure 2) and strings can be used to play any given note in Western Classical technique. The following parameters have been applied to the table. There is a limit put on each string of two octaves, and *harmonics* will not be included.[16] The table is designed to illustrate that there are numerous ways to play any given note, and this can be achieved through analysing standard violin playing without extra effects and the extreme limits of high *positions* outside a two octave range per string.

Figure 2. Violin left hand nomenclature.

[16] The reason for this is that natural *harmonics* can either be a part of a *frame* or *extension*, in the same way that a 'normal' note can. Hence any natural *harmonics* can be considered the same as the normal note sharing their pitch. Therefore the harmonic sound will be considered an effect, in the same way that a dynamic or articulation can be considered an effect and is consequently not relevant in this table. *Stopped harmonics* will also be excluded.

Table 1. Possible fingerings for every note on the violin.

Note	G String	D String	A String	E String
G	0			
G#	1			
A	1, 2			
A#	1, 2, 3			
B	1, 2, 3, 4			
Middle C	1, 2, 3, 4			
C#	1, 2, 3, 4			
D	1, 2, 3, 4	0		
D#	1, 2, 3, 4	1		
E	1, 2, 3, 4	1, 2		
F	1, 2, 3, 4	1, 2, 3		
F#	1, 2, 3, 4	1, 2, 3, 4		
G	1, 2, 3, 4	1, 2, 3, 4		
G#	1, 2, 3, 4	1, 2, 3, 4		
A	1, 2, 3, 4	1, 2, 3, 4	0	
A#	1, 2, 3, 4	1, 2, 3, 4	1	
B	1, 2, 3, 4	1, 2, 3, 4	1, 2	
C one octave above middle C	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3	
C#	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	
D	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	
D#	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	
E	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	0
F	2, 3, 4	1, 2, 3, 4	1, 2, 3, 4	1
F#	3, 4	1, 2, 3, 4	1, 2, 3, 4	1, 2
G	4	1, 2, 3, 4	1, 2, 3, 4	1, 2, 3
G#		1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4
A		1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4
A#		1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4
B		1, 2, 3, 4	1, 2, 3, 4	1, 2, 3, 4
C two octaves above middle C		2, 3, 4	1, 2, 3, 4	1, 2, 3, 4
C#		3, 4	1, 2, 3, 4	1, 2, 3, 4
D		4	1, 2, 3, 4	1, 2, 3, 4
D#			1, 2, 3, 4	1, 2, 3, 4
E			1, 2, 3, 4	1, 2, 3, 4
F			1, 2, 3, 4	1, 2, 3, 4
F#			1, 2, 3, 4	1, 2, 3, 4
G			2, 3, 4	1, 2, 3, 4
G#			3, 4	1, 2, 3, 4
A			4	1, 2, 3, 4
A#				1, 2, 3, 4
B				1, 2, 3, 4
C three octaves above middle C				1, 2, 3, 4
C#				1, 2, 3, 4
D				2, 3, 4
D#				3, 4
E				4

In the table above it is clear that the majority of pitches on the violin have more than one way of executing them in both practice and performance. When an individual note is combined with surrounding notes this can spiral exponentially into large combinations of different ways to play the same note. The following example explores this on a small scale to demonstrate high element interactivity.

When reading middle C, there are four possibilities (as the note can be played on any finger, refer to Table 1 above). If for example the next written note is the D above it, we have five possibilities (four for each finger on the G string and one for the open D string). Multiplying these possibilities together with the four possibilities for middle C gives the total number of combinations of finger and string choice when these two elements are combined. For just these two notes there are a potential 20 different ways to play them (refer to Calculation 1 in Table 2 below). In addition to this, to get from any note to the next one, there are 14 options: retaining the *position* on the fingerboard; using any of Challen's *frames* from her method (a total of eight, discussed in subchapter 2.1); an *extension* either towards or away from the bridge and with an interval of a minor third or major third (a total of four possibilities); or a *shift*. If we then consider the middle C to D example above, that's 20 potential ways to play the two notes consecutively, multiplied by the 14 possible ways of moving between them, which is equivalent to a total of 280 potential ways to play just two notes (refer to Calculation 2 in Table 2 below). That's 280 very quick decisions that have to be made in real-time when reading. While this can be eliminated to an extent with experience and knowledge of what fingerings work best, nevertheless this is a considerable amount of information to process.

Table 2. Combinatorial of different ways in which the notes middle C to D could be played.

Calculation 1	**Calculation 2**
4 x 5 = 20	20 x 14 = 280

Having to process a large number of options for each note very quickly, increases the possibility of misinterpreting a note and playing it a semitone out by simply misreading the sharps, flats and naturals.

1.3. Problems With Left Hand Technique.

The reason it is essential for a string player to find a suitable way to process all of the semitone and tone placement in the left hand correctly, is so that this information on the positions of the fingers can be programmed and retained through muscle memory. Muscle memory, as well as the ear, is essential for good intonation.[17] The issue with muscle memory is that when sight-reading, ideally the music must be played correctly from the first read through, so that no incorrect notes or insecure intonation can work its way into the memory from those early stages of learning.[18] But when reading unfamiliar music this is not always possible. The following chapter addresses the current systems that attempt to reduce forming incorrect muscle memory.

Ivan Galamian used a taxonomy of hand frames in his violin method book to spell out a series of basic semitone placement combinations.[19] This comprised of four simple hand frames,[20] STT, TST, TTS, and TTT (see Abbreviations), as well as frames using *extensions*.[21] These *extensions* facilitate a technique used to eliminate noticeable *shifts*, colloquially referred to as 'creeping.'[22] This is where hand frames start to become difficult to maintain.

In early methods of learning the violin, the odd numbered *positions* were favoured. While this is less common now, it has resulted in the general consensus that the odd *positions* (one, three, five etc.) are the

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[17] Cynthia Darling, "Muscle memory, ear training, and intonation," *Teaching Music* 17, no. 1 (2009): 49, accessed September 28, 2016, http://go.galegroup.com/ps/i.do?p=AONE&sw=w&u=cowan&v=2.1&id=GALE%7CA206054883&it=r&asid=4625a1d4deb0e78cc220e8ce9bd8b1f8.

[18] "Piano Technique: Muscle Memory," accessed September 28, 2016, http://www.piano-ology.com/Technique/MuscleMemory.php.

[19] Ivan Galamian, *Principles of Violin Play & Teaching*, (New Jersey: Prentice-Hall Inc., 1962), 16.
Galamian's approach to organisation of the left hand is most similar to Challen's Method, however it is worth noting that there are other approaches such as Demetrius Constantine Dounis', which advocates 'finger independence.'
Demetrius Constantine Dounis, *The Absolute Independence of the Fingers: In Violin Playing on a Scientific Basis, Op. 15* (New York: Carl Fischer, 2005), 89.

[20] Galamian, *Principles of Violin Play & Teaching*, 16.

[21] Galamian, *Principles of Violin Play & Teaching*, 26.

[22] Galamian, *Principles of Violin Play & Teaching*, 26, 34–35.

easiest to play in and are therefore, to an extent, more common.[23] Third *position* (see Figure 3) is also usually the first new *position* learned after first *position* resulting in a preference for it over some other *positions* which are learned later. The 'creeping' technique breaks down the normal *position* system which often leads to the violinist becoming caught in less frequently used or unfamiliar *positions*.[24] Leopold Auer expressed his concern that this practice was causing the common occurrence of the semitones becoming too far apart.[25] Several strategies for preventing this were proposed. Francesco Geminiani suggested that stickers be put on the fingerboard as a guide for where the semitones should be placed.[26] However it is not always sufficient for correct semitone placement as the stickers only address the issue of accuracy of intonation. An accurate semitone is a good start, but this method assumes that the violinist already knows the correct location of every semitone in any given piece, which without prior practice, is not always a realistic assumption.

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[23] Galamian, *Principles of Violin Play & Teaching*, 32.

[24] Catharine Lee Carroll, "A comprehensive overview of violin/viola left-hand technique as it applies to articulation, intonation, shifting, and vibrato," (PhD diss., University of Cincinnati, 1997), 39.

[25] Leopold Auer, *Violin Playing As I Teach It* (New York: Frederick Strokes Company, 1921), 94, accessed March 31, 2016, http://imslp.org/wiki/Violin_Playing_as_I_Teach_It_(Auer,_Leopold).

[26] Francesco Geminiani, *The Art of Playing on the Violin*, (London: n.p., 1751), 2, accessed March 31, 2016. http://imslp.org/wiki/The_Art_of_Playing_on_the_Violin,_Op.9_(Geminiani,_Francesco).

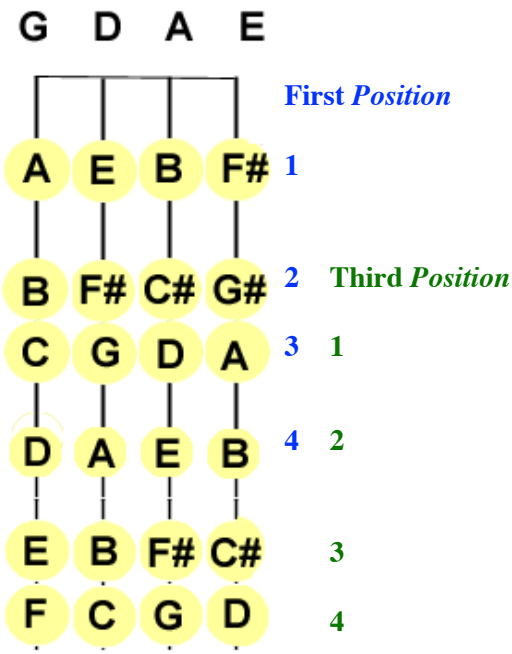

Figure 3. First and third *positions*.[27]

Other strategies to avoid widening semitones and semitone placement mistakes, include the basic technique of leaving previously used fingers down for as long as possible, in an attempt to retain the integrity of the frames in Galamian's method book.[28] In addition to this, Auer recommended that students should not rush through new repertoire and dedicate enough time to each individual note.[29] Neither of these strategies are measurable like Geminiani's proposal for the use of stickers to mark tones and semitones, and can therefore be hard to implement correctly and consistently.

However, Galamian briefly discussed an approach that calls for further investigation. He stated that playing with good left hand technique is about combining the sensations of touch and hearing.[30] This brings to light the concept of synaesthesia in music, and its artificial counterpart: pseudo-synaesthesia.[31]

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[27] "Fiddle Finger Chart," accessed October 24, 2016, http://www.learningviolin.com/fiddlefingerchart3.gif.

[28] Suzanne Nelson, "Twentieth-century violin technique: The contributions of six major pedagogues," (PhD diss., University of South Carolina, 1994), 109, accessed April 5, 2016, ProQuest (AAT 9517295).

[29] Auer, *Violin Playing As I Teach It*, 100.

[30] Galamian, *Principles of Violin Play & Teaching*, 16.

[31] John Harrison and Simon Baron-Cohen, "Synaesthesia: An Account of Coloured Hearing," *Leonardo* 27, no. 4 (1994): 345, accessed April 3, 2016, doi:10.2307/1576010.

1.4. Artificial Synaesthesia

Synaesthesia is a term used to describe the phenomenon of the stimulation of one sense triggering another. Common things that can activate chromatic (colour) synaesthetic experiences include letters, numbers, words and music (called 'inducers').[32] Based on the current results of research tests, synaesthesia cannot be learnt.[33] The method of research that attempted to replicate synaesthesia in individuals who did not previously experience it, involved repeated exposure to an inducer paired with a colour. In a study done in 1934, pitch was linked to colours through showing non-synaesthetic subjects thousands of repetitions of notes and colours simultaneously. But not one participant in the study actually experienced a colour when asked to listen to the notes of the C major scale.[34] Despite this, synaesthesia can be copied so that an association between two senses becomes automatic.[35] This is sometimes referred to as artificial synaesthesia or 'pseudo-synaesthesia.'[36] Despite none of the participants in the study actually seeing any colours, they did form strong associations between pitch and colour.[37]

During a study in 1956, it was proven that when searching for an item, the search time is dependent on the number of items. However when a subject is told the colour of the item in question, the search time is dependent on the number items of that colour. Therefore if the number of items of one colour is less than the number of total items, the search time and therefore reaction time, is reduced.[38] To link this information to pseudo-synaesthesia, a study published in 2011 recorded the response time for linking

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[32] Lynn C. Robertson and Noam Sagiv, *Synesthesia*, (Cary, United States: Oxford University Press, 2004), accessed April 6, 2016, 3–4, http://site.ebrary.com.ezproxy.ecu.edu.au/lib/ecu/reader.action?docID=10103528.

[33] Everett Lowell Kelly, "An experimental attempt to produce artificial chromaesthesia by the technique of the conditioned response," *Journal Of Experimental Psychology* 17, no. 3 (1934): 324-330, accessed April 7, 2016, doi:10.1037/h0074963.

[34] Kelly, "An experimental attempt to produce artificial chromaesthesia by the technique of the conditioned response," 324-330.

[35] Nicolas Rothen and Beat Meier, "Acquiring Synaesthesia: Insights from Training Studies," *Frontiers in Human Neuroscience* 8 (2014): 9, accessed April 3, 2016. 2016, doi:10.3389/fnhum.2014.00109.

[36] Harrison and Baron-Cohen, "Synaesthesia: An Account of Coloured Hearing," 345.

[37] Kelly, "An experimental attempt to produce artificial chromaesthesia by the technique of the conditioned response," 324-330.

[38] Bert F. Green and Lois K. Anderson, "Colour Coding in a Visual Search Task," *Journal of Experimental Psychology* 51, no. 1 (1956): 19–24, accessed April 17, 2016, http://dx.doi.org.ezproxy.ecu.edu.au/10.1037/h0047484.

letters and colours for both synaesthetes and non-synaesthetes.[39] When shown the letters, there was very little difference between the time it took for the synaesthetes to see colours, and for the non-synaesthetes to think of the correct colours through association. There was some variation when the colours were placed in different areas relative to their original position to the letters, in which the non-synaesthetes actually performed better. But when all the results were combined, the time for both synaesthetes and non-synaesthetes showed no conclusive variance.[40] This proved that pseudo-synaesthesia could mimic the automatic response times of genuine synaesthesia.

There are already examples of pseudo-synaesthesia applied in music. Kodály's Solfa system links words and hand shapes to scale degrees.[41] Studies show that children who are exposed to coloured pitches over a long period of time start to experience pseudo-synaesthesia.[42] In 1996, Rogers conducted a study on using coloured notation in sight-reading rhythm.[43] Grade one and two students were tested on sight-reading both a coloured and un-coloured rhythm, after exposure to both in the classroom. Students scored significantly better when reading the coloured rhythm, and when interviewed said they perceived the coloured notation as being easier.[44] While this article does not go into pseudo-synaesthetic associations in

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[39] Jun Saiki, Ayako Yoshioka and Hiroki Yamamoto, "Type-based associations in grapheme-color synaesthesia revealed by response time distribution analyses," *Consciousness and Cognition* 20, no. 4 (2011): 1551, accessed April 7, 2016, doi:10.1016/j.concog.2011.07.005.

[40] Saiki, et al., "Type-based associations in grapheme-color synaesthesia revealed by response time distribution analyses," 1553–1556.

[41] Valeri Brainin, "Employment of Multicultural and Interdisciplinary Ideas in Ear Training ("Microchromatic" Pitch. "Coloured" Pitch)," (paper presented at the International Society for Music Education 28th World Conference, Bologna, Italy, July 20-25, 2008), 57, accessed March 31, 2016, http://citeseerx.ist.psu.edu/index.

[42] Brainin, "Employment of Multicultural and Interdisciplinary Ideas in Ear Training ("Microchromatic" Pitch. "Coloured" Pitch)," 56.

In further extension of this, the Colourstrings method also uses the pedagogy techniques of Kodály in combination with colour assignment to the strings of the violin.

"Background," 2014, accessed February 23, 2017, http://www.colourstrings.co.uk/Background.htm.

[43] George L. Rogers, "Effect of Coloured Rhythmic Notation on Music-Reading Skills of Elementary Students," *Journal of Research in Music Education* 44, no. 1 (1996): 18, accessed April 11, 2016, http://www.jstor.org.ezproxy.ecu.edu.au/stable/3345410.

[44] Rogers, "Effect of Coloured Rhythmic Notation on Music-Reading Skills of Elementary Students," 22–23.

detail, it does suggest that 'cross-sensory association' could have played a part in the success of the study.[45]

Touch induced synaesthesia is very rare, but Simner documented the experience of a woman who sees colours in her mind's eye when exploring texture with her hands.[46] In terms of existing pseudo-synaesthetic methods in music that utilise this specific phenomenon, Sharon Goodey, has developed a system for piano teaching, where each finger is associated with a different colour.[47] Her reasoning for creating the method was an observation that sometimes it wasn't technical ability that limited her students, but their reading ability.[48] The colour-coded fingers were her answer to this problem. They transcend position changes, and even note names when used in conjunction with her numbered stave, so that her students can quickly decipher what notes to play.[49] The *Finger Frames* method exploits touch to colour pseudo-synaesthesia, by taking learned colour to hand shape associations and using them to catalogue semitone placement in a clear and concise way.

By combining this research on different theories together it can be proposed that it is possible for more working memory space to be freed up while reading music for the violin. Pseudo-synaesthesia has it's grounding in the psychological sciences, which propose that using colour to categorise information elicits quick automatic reaction times in a similar way to genuine synaesthesia. In addition to this, encoding multiple pieces of information into a single group (in this case represented by a colour) can be referred to as 'chunking.'[50] This results in working with a smaller number of individual elements and therefore reducing element interactivity and in turn cognitive load. The following chapter will address how using

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[45] Rogers, "Effect of Coloured Rhythmic Notation on Music-Reading Skills of Elementary Students," 23.

[46] Julia Simner and Vera U. Ludwig, "The color of touch: A case of tactile–visual synaesthesia," *Neurocase: The Neural Basis of Cognition* 18, no. 2 (2012): 167–168, accessed April 17, 2016, doi:10.1080/13554794.2011.568503.

[47] "Reviews & Articles."

[48] "Reviews & Articles."

[49] "Reviews & Articles."

[50] Daniel J. Levitin, *Foundations of Cognitive Psychology: Core Readings*, (London: MIT Press, 2002), 297.

colours to represent chunking the four fingers of the left hand together can help to reduce the intrinsic cognitive load of reading music as a violinist.

Chapter 2. *Finger Frames* in Practice

The following chapter will include a discussion of what the *finger frames* are; how they can be applied to a specific piece; an example of the versatility of the method and it's ability to be adapted to suit the individual; and an evaluation of the frequency of the occurrence of each *frame* within a piece.

2.1. The *Finger Frames* Method

Fleur Challen, who has been playing with the Western Australian Symphony Orchestra for 30 years, began developing the *Finger Frames* method around five years ago for two reasons. The first being in response to a playing injury in her left hand, and the second, to help her students to retain more information about the pieces they were playing. The discussion of the method's proposed ability to address sight-reading accuracy is almost secondary to these first two initial aims, as from these two ideas stemmed many far reaching effects that result from thinking in *frames*. For example, while Challen created the *frames* to overcome challenges in teaching and playing, she also found that they achieved a focused and 'centred' sound.[51] The *Finger Frames* method organises every aspect of left hand playing, and this requires forethought behind each note resulting in the execution of each note being performed with strength and purpose, ultimately leading to a more focused and concentrated sound.[52] This effect is not the focus of this paper, but it is important to note that the proposal that *finger frames* assist with music reading is only one aspect of its possible effects.

There are currently no published sources that explain Challen's *finger frames* and therefore the basics of the method will be described. A *finger frame* (or *frame*) refers to a specific combination of the spacing of fingers in the left hand that a string player may use on the fingerboard to which a colour has been assigned. The *Finger Frames* method (which has only been applied to violin playing at this point) works by assigning a colour to each possible pattern of tones and semitones (see Figure 4) and overlaying this onto sheet music with coloured pencil or pen, without changing the existing notation of a piece (see Figure 5). Therefore it is a requirement of usage of this method that the violinist can read music. In order

[51] Challen, interviewed by the author, September 2016.

[52] Challen, interviewed by the author, September 2016.

to utilise the method, a violinist must learn each pattern or *frame* so that it is automatic, and the left hand must be set up correctly and accurately. A colour is indicated in the music score to instruct the performer when to use a specific *frame*. The *frames* are put into practice by examining where the semitones are, what *position* they need to be played in and with what fingers, so that a framework of colours that show where every single *frame* needs to be can be filled in.

Block	1st Pos
T T S	E
T S T	E
S T T	E
T T T	F
S S S	D
S T S	D#/Eb
T S S	D#/Eb

Figure 4. Table of *frames* showing the chosen colours and 4th finger pitch when played in first *position*.[53]

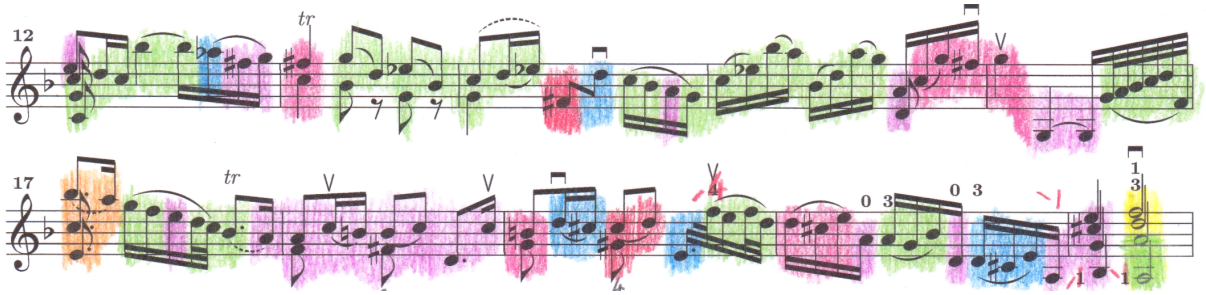

Figure 5. Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 20–21.[54]

Since the printing of the image in Figure 4, there have been two more *frames* added to the method by Challen, shown in Table 3.

Table 3. Additional list of rare *frames* and their corresponding colours.

Tones and Semitones	**First *Position* (4th finger)**	**Colour**
SST	D#/E*b*	Light Green
S+T (minor third) or T+T (major third)	NA	Light Blue

[53] Image given in hard copy form to the author by Challen during a violin lesson in 2014.

[54] Johann Sebastian Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," in *International Music Score Library Project*, *Petrucci Music Library*, ed. Werner Icking. (N.p.: Werner Icking Estate, 1998), 24.

Colours that are capitalised (i.e. ‘Green’ as opposed to ‘green’) are used to refer to the different *frames*. The Light Green (SST) and Light Blue (T+S) *frames* in Table 3 do not have set colours. For these *frames* any other available colour may be used. Light green and light blue are the author’s preferred colours.

Each *frame* is unique and has it’s own set of properties which must be considered when deciding which *frames* to use. The following features are based on Challen's and the author’s personal use of the method. According to Challen, Green (TTS) (Figure 6.1), Blue (TST) (Figure 6.2) and Pink (STT) (Figure 6.3) are by far the most common of the *frames*.[55] This is discussed in more detail in subchapter 2.4. Challen also states that of these common *frames*, Green (TTS) is the most comfortable and ‘natural’ feeling. The Green *frame* places the 3rd and 4th fingers right next to each other, giving the 4th finger more support which helps to compensate for it’s innate weakness due to it’s smaller size. TST (coloured with blue in Challen’s method) is the most common hand position that beginning students will learn first,[56] so the hand learns to feel comfortable in this pattern before any other. The Pink *frame* (STT) requires more stretching by the 3rd and 4th fingers which can feel less comfortable.[57] For these reasons, when there are several choices for which *frame* to use, Green should always be considered first, and then if Green does not fit, Blue and then Pink respectively. A complete visual taxonomy including all *frames* from Figure 4 and Table 3 is included in Appendix A.

[55] Challen, interviewed by the author, September 2016.

[56] Kathy Blackwell and David Blackwell, *Fiddle Time Joggers* (Oxford: Oxford University Press, 2001), 9–31.

[57] Challen, interviewed by the author, September 2016.

Figure 6.1. Green *frame* (TTS).

Figure 6.2. Blue *frame* (STS).

Figure 6.3. Pink *frame* (STT).

The Purple *frame* (SSS) has two uses. The first being the actual *frame*, having every finger close together to form three semitones in a row, and the second, as a reminder to relax the hand. When the hand is relaxed the fingers naturally move closer together in a similar way to the three semitones of the Purple *frame*. Therefore Purple can be used to signal the violinist to relax their hand. This could be used for an

open string, or when only one finger is being used, meaning that the rest of the *frame* is irrelevant.[58] It is also a working memory 'break'; Purple gives the violinist a chance to let go of any previous *frames* and mentally prepare to process the *frames* ahead.

The Orange *frame* (STS) is fairly uncommon, but a very strong position. This *frame* places the 1st and 2nd fingers and 3rd and 4th fingers next to each other respectively so that every finger is reinforced by the closeness and strength of each adjacent finger.[59] Red (TSS) and Light Green (SST) are the most uncommon and therefore weakest, due to their relative unfamiliarity. Red (TSS) groups the three weakest fingers together (2nd, 3rd and 4th) and Light Green (SST) groups the three strongest together (1st, 2nd and 3rd) leaving the 4th and weakest finger on its own. For this reason the Light Green *frame* is barely used at all and is only found occasionally when playing four note chords in works by composers such as Johann Sebastian Bach (see Figure 7).

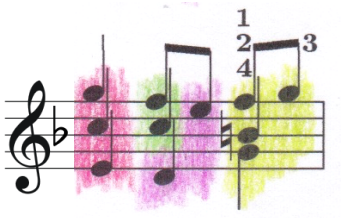

Figure 7. Light Green *frame* (SST). Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 11.[60]

Yellow (TTT) and Light Blue (T+S) are the only *frames* that extend outside the *octave hand frame*. Light Blue is not so much a *frame*, but more a way to notate *extending* a finger more than a tone.[61] This could be either a minor or major third; for any interval wider than this, in most cases, it becomes more effective to *shift* rather than *extend* the finger. Sometimes a plus symbol can be used in conjunction with the Light Blue *frame* to reinforce the indication of an *extension* (see Figure 8). *Shifts* are also indicated by

[58] Challen, interviewed by the author, September 2016.

[59] Challen, interviewed by the author, September 2016.

[60] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

[61] Challen, interviewed by the author, September 2016.

using the colour red, along with a diagonal dash pointing upwards to indicated a *shift* up towards the bridge or vice versa to show a *shift* down towards the scroll (see Figure 8).

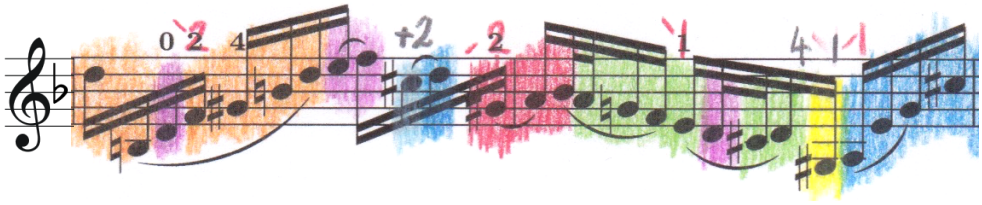

Figure 8. Plus symbol to notate an *extension*; *shifts* and *shift* directions written in red. Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 26–27.[62]

It is worth noting that Challen's *extensions* are not within the standard method of *extending*. Rather than reaching out of one of her *frames*, she prefers to add a slight *shift* on an adjacent finger (to the one *extending*) so that the *frame* is retained while she moves and the strength of her hand position is continued.[63] Light Blue thus refers to this kind of *extension*.

Using the above features of each *frame*, the following G major scale (see Figure 9.1) will be used as an example of how to *frame* a piece. Figure 9.1 shows all the information required for fingerings (the numbers above the stave) and the tones and semitones, which have been written in along with the standard indication of triangle shaped lines marked between the semitones.

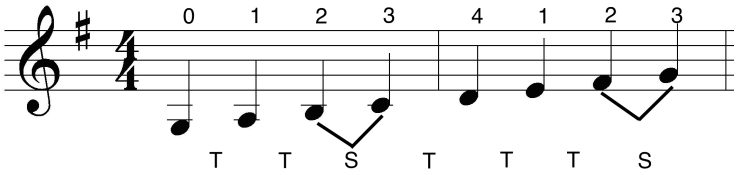

Figure 9.1. G Major Scale with fingerings and T and S indications.

The first note in Figure 9.1 is an *open string* and can therefore be coloured purple. The next four notes (A, B, C and D) form a TST pattern which is Blue. The final three notes (E, F# and G) are slightly different. They form a TS pattern, and there are two *frames* that begin with that combination: Red (TSS)

[62] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

[63] Challen, interviewed by the author, September 2016.

and Blue (TST) (see Figure 4). Blue is the more common and more familiar *frame* so therefore the TS pattern, when lacking the final note to form either a full Red or Blue *frame*, is almost always Blue (see Figure 9.2).

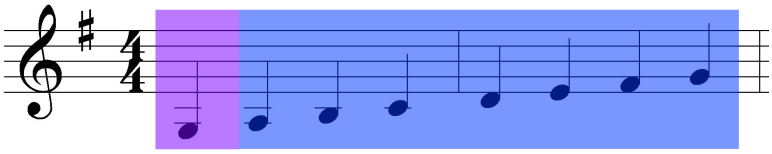

Figure 9.2. *Framed* G Major Scale.

The decision about which *frame* to use for an incomplete pattern is somewhat dictated by the individual's preference for certain *frames*. For example, the pattern ST could be either Orange (STS) or Pink (STT). Pink is the more familiar *frame*, but Orange is a 'strong' feeling *frame*. Each individual will have their own preference for which one to use, and this may change in certain situations based on what *frames* are before and after the incomplete *frame*.[64] A more detailed step by step explanation of how to put the method into place will be explored in subchapter 2.3.

[64] Challen, interviewed by the author, September 2016.

2.2. The Author's Personal Additions to the Method

The basics of this method can be applied effectively without any modification. The following additions were made to cater specifically to the author's individual needs and to demonstrate that this is a versatile system.

As briefly explained above, a plus symbol can be used to show an *extension*. However if the violinist desires to make this more specific by notating which direction on the fingerboard an *extension* is moving, a symbol presented in Galamian's violin method book can indicate an *extension* towards the scroll. The symbol looks like a plus sign with a second horizontal line through it. (see Figure 10).[65]

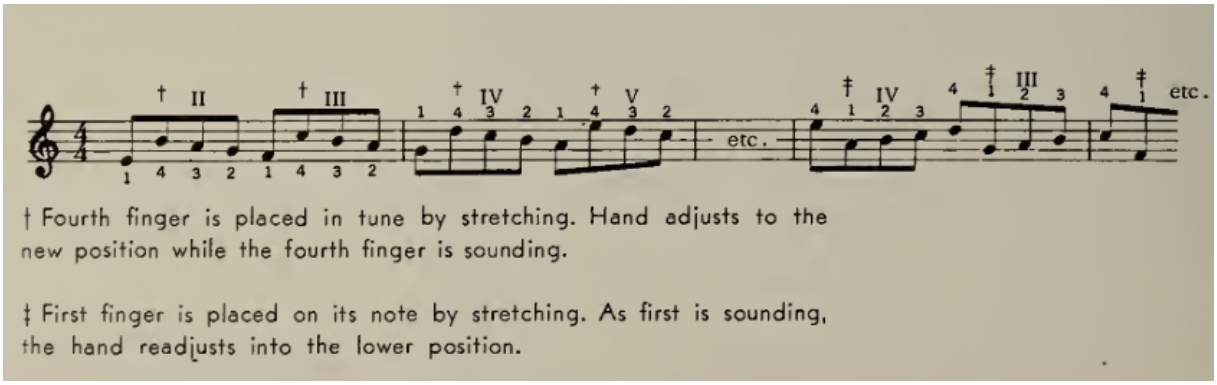

Figure 10. *Extension* Notation in Galamian's Principles of Violin Playing and Teaching.[66]

Light Blue *frame* (T+S) *extensions* can also span, in most cases, either a minor or major third (see subchapter 2.1 for further information on Challen's *extensions*). The author's proposed way to define this is to use two symbols for the major third *extension* and one for the minor third *extension*. Ie. + (m3 *extension* up), ++ (M3 *extension* up), ≠ (m3 *extension* down), ≠ ≠ (M3 *extension* down).

The final addition to the method is a more fundamental element. In pieces that use the harmonic scale, the repeated use of the minor third interval between the sixth and seventh scale degrees can sometimes be too much for repeated *extensions*. *Extensions*, as stated by Galamian, are a vessel for 'creeping' and

[65] Galamian, *Principles of Violin Play & Teaching*, 34.

[66] Galamian, *Principles of Violin Play & Teaching*, 34.

changing *position*.[67] A proposed new *frame* (assigned the colour brown), designed to stay in *position* (that is, to not *shift* or implement an *extension*) and cater to a repeated minor third interval between the 2nd and 3rd fingers, uses the pattern ST+SS or Sm3S (see Figure 11).

Figure 11. Brown *frame* (ST+SS, Sm3S).

[67] Galamian, *Principles of Violin Play & Teaching*, 34–35.

2.3. *Finger Frames* in Practice: Bach, Partita No. 2 in D minor for Solo Violin, Sarabande.

This subchapter will discuss *framed* examples from Bach's Sarabande in D minor for solo violin (See Appendix B). The scope of this research paper only allows room for in depth description of one *framed* piece. Because using *finger frames* is subjective to some extent, every piece has several ways in which it can be approached.[68] These examples aim to demonstrate some cases that require special attention.

Each note or chord's colour is calculated from the previous note or chord. In Figure 12.1 below, the Blue D and the Green C that follows it have a Green (TTS) relationship (see Figure 12.2) (they are played with a tone between the 3rd and 2nd fingers). The reason the note D is coloured Blue (TST) is because of it's Blue relationship (see Figure 12.3) with the F# before it (a semitone between 2nd and 3rd fingers).

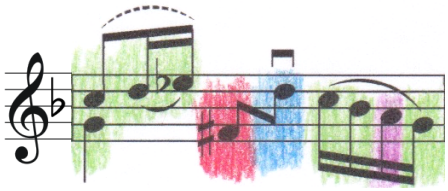

Figure 12.1. Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 14.[69]

Figure 12.2. Green *frame* (TTS).

[68] Challen, interviewed by the author, September 2016.

[69] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

Figure 12.3. Blue *frame* (TST).

Chords

Frames can be used in single line passages with no *double stops*, however they can also be used in situations where several or all fingers are needed to play many notes at once. Some chords require only one *frame* that can be retained throughout the entire chord while the bow is rolled across the necessary strings (see Figure 13.1), while other chords require several *frames*. In Figure 13.2, the four note chord in beat two is played in two parts. The first part with a Green *frame* (TTS), and the second part with a Yellow *frame* (TTT). The 1st finger A in the Green part of the chord must be lifted in order to play the Yellow part, while the Green 4th finger A can remain down. Therefore the second part of the chord is calculated in relation to the Green 4th finger.

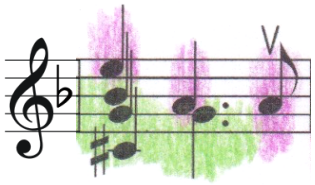

Figure 13.1. Green four note chord. Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 2.[70]

[70] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

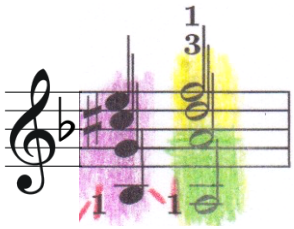

Figure 13.2. Four note chord split into two *frames*. Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 21.[71]

Similar *Frames*

Figure 14 shows a subjective decision about when to introduce the Blue *frame*. Red (TSS) and Blue (TST) share a semitone between the 2nd and 3rd fingers. It could therefore be argued that the semitone between the C# and D could remain Red on the latter note. However the decision to change to Blue on the note D was made because Blue is the more familiar *frame*, and it is beneficial to return to the standard Green, Blue and Pink *frames* wherever possible.

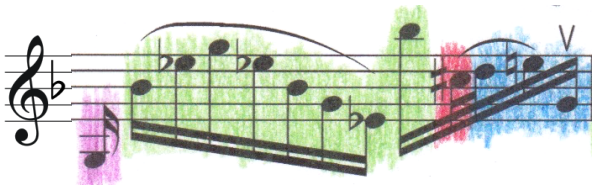

Figure 14. Transition from the Red to Blue *frame*. Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 22.[72]

The Purple *Frame*

As noted in subchapter 2.1, Purple (SSS) has several uses. The first is to notate relaxing the hand and closing in all the fingers. This is usually done in two situations; *open strings* (see Figure 15.1), and 1st fingers that are not part of another *frame* (see Figure 15.2). Figure 15.2 shows a *shift* from second *position* (the Blue *framed* section) to a 1st finger A in first *position*. Directly after this at the start of bar 21 is a *shift* back to second *position*, meaning that the 1st finger A is not surrounded by any other *frames* in its *position*. In addition to this, the chord at the start of bar 21 is Purple, and therefore Purple is the only

[71] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

[72] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

logical choice for this isolated 1st finger, as it also sets up the hand for bar 21. The second use for Purple is the actual *frame* itself; semitones between every finger (see Figure 15.3).

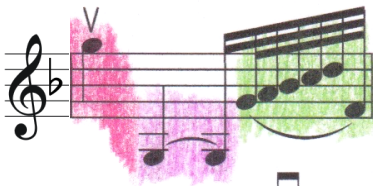

Figure 15.1. Purple *frame* on an *open string*. Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 16.[73]

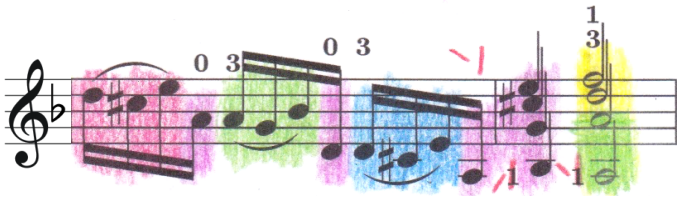

Figure 15.2. Purple *frame* on a 1st finger that is not part of another *frame*. Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 20–21.[74]

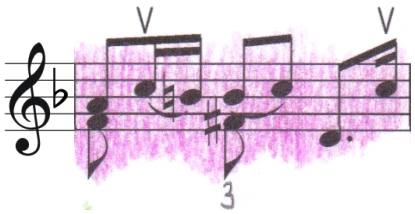

Figure 15.3. Purple *frame* using 1st, 2nd, and 3rd fingers (as well as open A string and open D string). Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 18.[75]

[73] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

[74] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

[75] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

2.4. Evaluation of *Frame* Frequency.

Frequency of *Frames*: Bach, Partita No. 2 in D Minor for Solo Violin, Sarabande.

Table 4. Percentage frequency of each *frame* in Bach's Partita No. 2 in D Minor for Solo Violin, Sarabande.[76]

Frame	**Percentage Frequency**
Green	34.0%
Blue	15.0%
Pink	14.4%
Purple	23.5%
Yellow	1.3%
Orange	6.9%
Red	2.6%
Light Green	1.3%
Light Blue	1.0%
Brown	0.0%

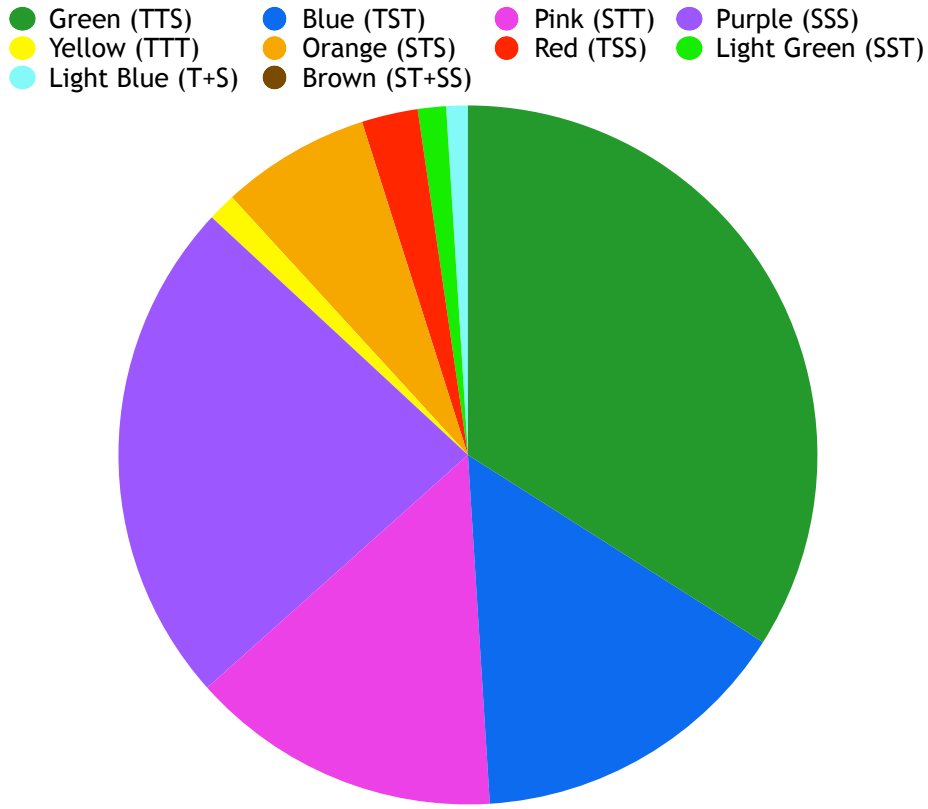

Figure 16. Percentage frequency pie graph of each *frame* in Bach Partita No. 2, Sarabande.

This examination of Bach's D minor Sarabande (see Appendix B), reflects Challen's statement from her interview (see Appendix E) that Green (TTS), Blue (TST), Pink (STT), and Purple (SSS) are the most common *frames*. The results also show the order of preference of the three most common *frames*, Green,

[76] Frequency calculated by counting the number of notes of each colour.

then Blue and then Pink; and also both the author's and Challen's personal preference for Orange. This particular piece has a slightly lower frequency of Yellow than is considered usual. *Frames* like Light Green and Red are often much less common than Yellow, however in solo violin works by Bach where there are many physically awkward four note chords, these *frames* tend to present themselves more often. The 1% frequency of Light Blue also supports Challen's statement that any *frame* that extends more than a tone between two fingers is exceptionally rare. This also applies to Brown, the author's own *frame*, which does not make an appearance here.

Frequency of *Frames*: Excerpt from Brahms, Symphony No. 4 in E minor, op. 98, Andante Moderato.

Table 5. Percentage frequency of each *frame* in Brahms' Symphony No. 4 in E minor, op. 98, Andante Moderato, mm 74–81.

Frame	**Percentage Frequency**
Green	42.7%
Blue	23.9%
Pink	5.1%
Purple	23.9%
Yellow	5.1%
Orange	0%
Red	0%
Light Green	0%
Light Blue	0%
Brown	0%

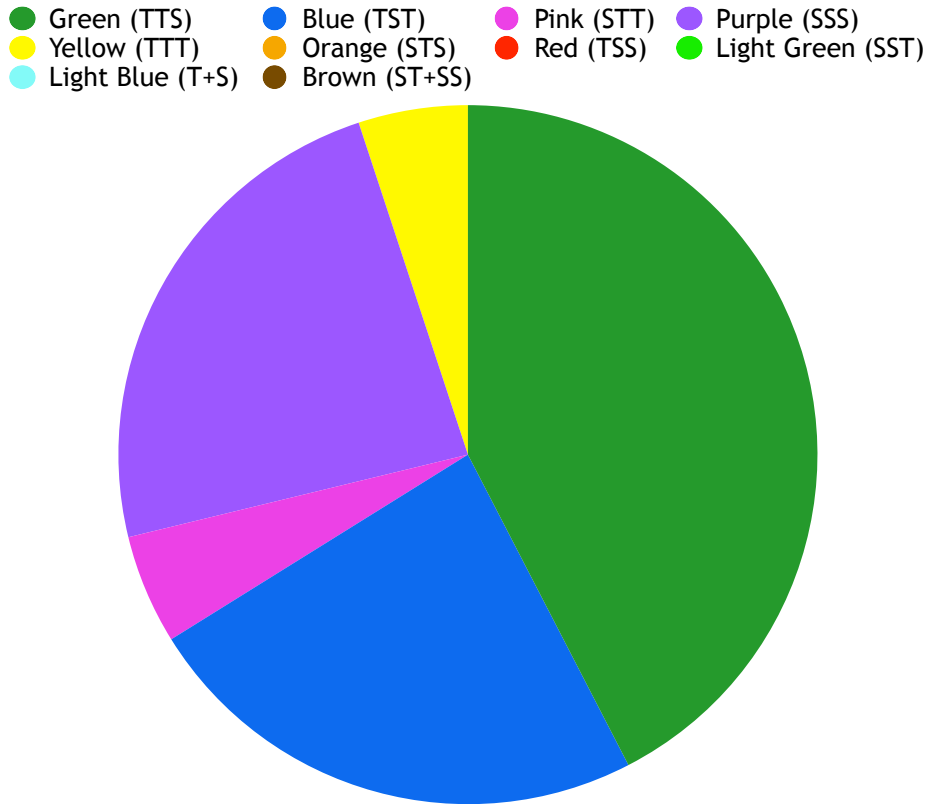

Figure 17. Percentage frequency pie graph of each *frame* in Brahms' Symphony No. 4 in E minor, op. 98, Andante Moderato, mm 74–81.

This excerpt, learned by the author for an Australian Youth Orchestra audition in 2014, was *framed* by Challen (see Appendix C). As it was the author's first experience with *frames* it only uses the most common *frames*, and like the frequency analysis of Bach's Sarabande, also conforms with Challen's statements about *frame* frequency. The three basic *frames* are again ordered Green (TTS), then Blue (TST) and then Pink (STT). Purple (SSS) is used with fairly high frequency as a reminder to relax the hand. Yellow (TTT) is one of the least used, and in this case is equal with Pink (STT). While Yellow is a fairly infrequent *frame* compared to the most common *frames*, it is usual for it to appear in most pieces.

Conclusion

The *Finger Frames* method organises a violinist's left hand so that every note is accounted for and part of a *frame*. The act of colouring music means that no note can be glossed over, as it's relationship with the surrounding notes must be explored in order to assign it a colour.

This altered sheet music presentation takes advantage of pseudo-synaesthetic associations that are created between hand frames and colours, and this could arguably suggest that it assists in sight-reading music as a violinist accurately. Research in the field of psychology proposes that using colour to categorise information elicits quick automatic reaction times. When the four fingers are 'chunked'[77] together in *frames* that are strengthened by correct muscle memory and their corresponding colours overlaid onto sheet music, the musician is working with less elements. This reduces element interactivity and therefore extraneous cognitive load. Hence overall cognitive load is reduced making the entire act of reading music while playing violin much less strenuous on working memory. The *Finger Frames* method reduces variation of fingerings in the left hand and leaves the musician with only one correctly notated visual representation of semitone placement. Therefore it can be deduced that using the method leaves the musician with more working memory space to concentrate on other less technical elements of a piece, including the expression and atmosphere the musician would like to project in performance.

Beneficial future research on this topic that could give more weight to the findings in this paper might include pitch analysis of numerous recordings played by students, with and without *frames* to track it's effect on the accuracy of pitch in sight-reading. Additionally, in a more time permitting environment it would be advantageous to investigate the long term effects of the method through exploration of case studies involving several students, by recording their progress to discover how either implementing Finger *frames* or not, affects a student's development.

[77] Daniel J. Levitin, *Foundations of Cognitive Psychology: Core Readings*, (London: MIT Press, 2002), 297.

Through the combination of the suggestions that *finger frames* organise the left hand, and that they assist in decreasing the cognitive load in reading sheet music, it can be strongly suggested that the method can lead to improved intonation and more accurate reading of new repertoire.

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Glossary

- Double stop - playing two or more notes simultaneously.
- Extension - Extending a finger outside the octave hand frame.[78]
- Finger Frames - refers to the method as a whole.
- Frame(s) or finger frame(s) - refers to the individual coloured frames within the Finger Frames method.
- Framed (vb.) - music that has been coloured.
- Frame (not italicised) - a combination of tones and semitones made by all four fingers of the left hand.
- Harmonics (natural harmonics) - points at halfway divisions along a string, that ring when a finger is rested upon them (as opposed to pushed down to touch the fingerboard).[79]
- Octave hand frame - When the gap between 1st and 4th finger is a perfect fourth when played on a single string, and an octave when played over two strings.[80]
- Open string - no fingers stopping a string.
- Position - the location of the hand on the fingerboard.
- Shift - to change position on the fingerboard.
- Stopped harmonics - harmonics created by stopping the string with one finger and playing a harmonic with another.
- 1st finger - index finger
- 2nd finger - middle finger
- 3rd finger - ring finger
- 4th finger - little finger

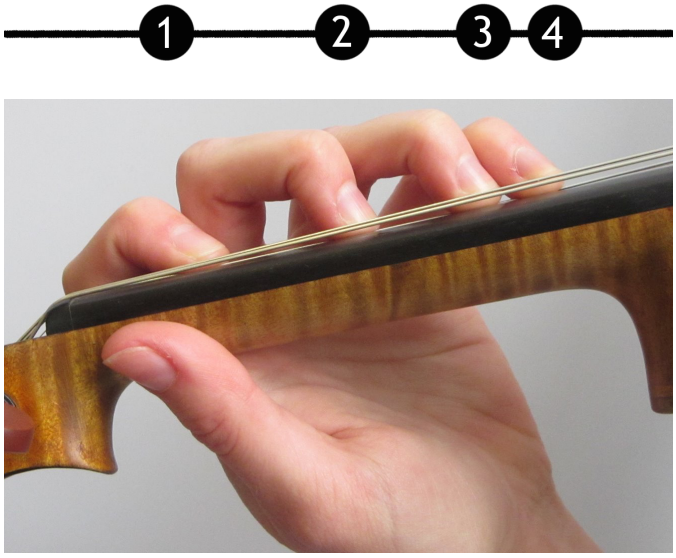
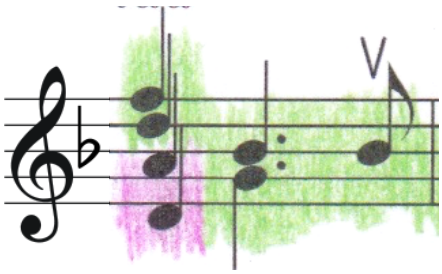
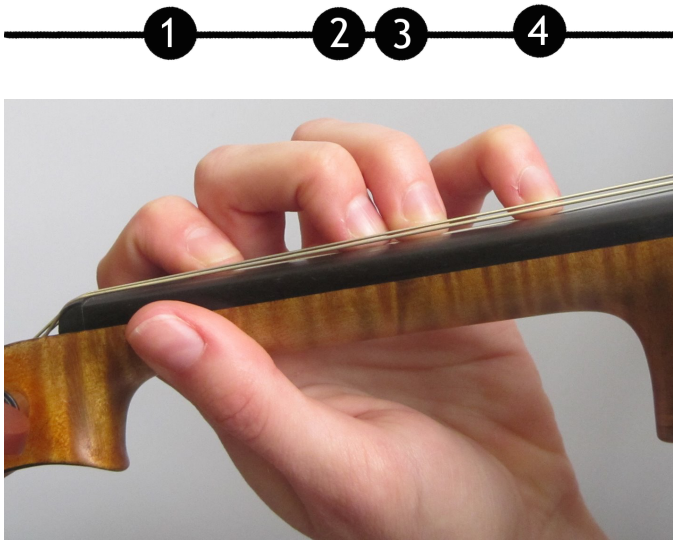
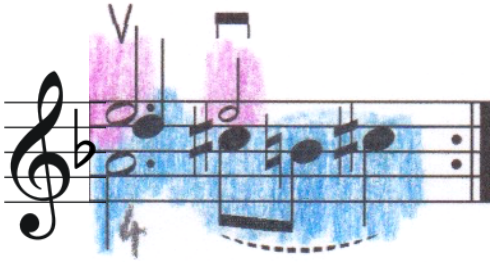
[78] Ivan Galamian, *Principles of Violin Play & Teaching*, 26.

[79] "Violin Basics: Violin Online Additional Skills," accessed June 16, 2016, http://www.violinonline.com/additionalskills.htm.

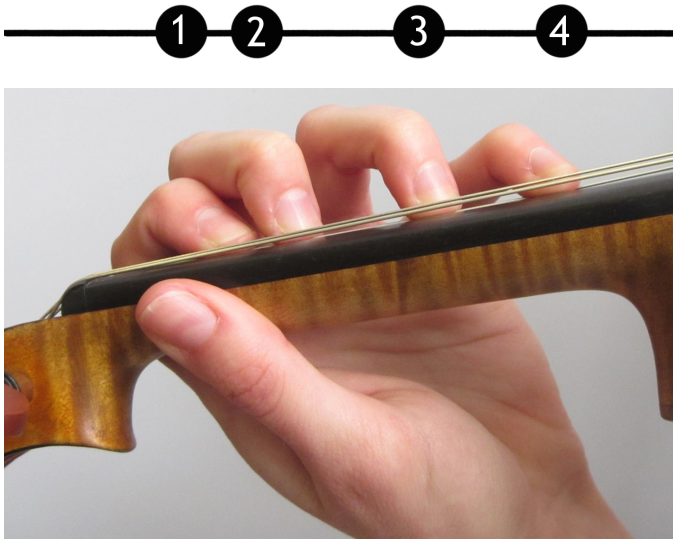
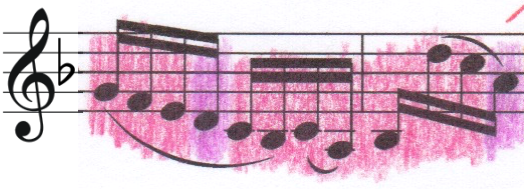
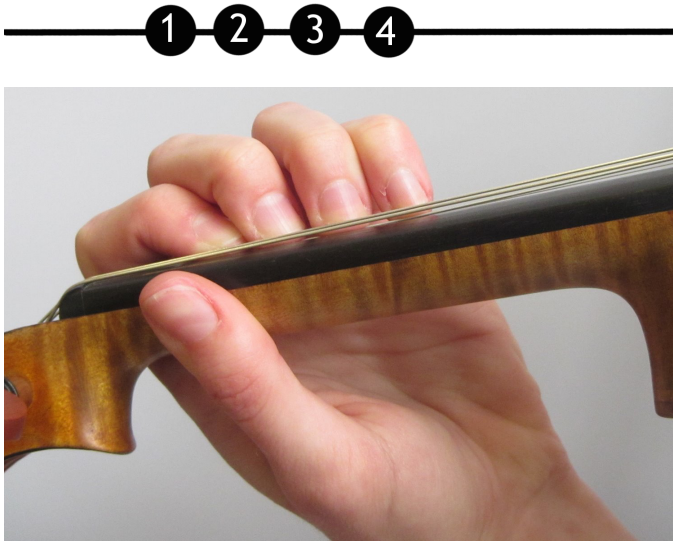
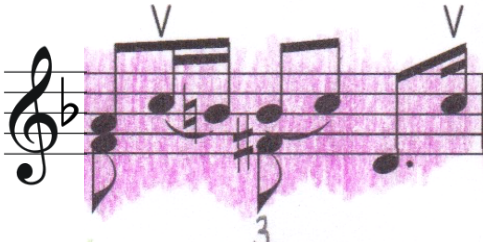
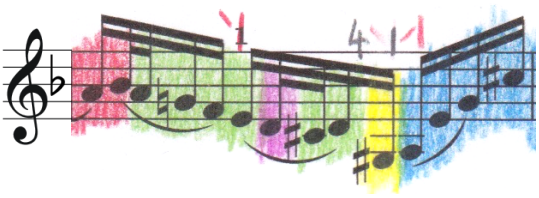
[80] Galamian, *Principles of Violin Play & Teaching*, 20.

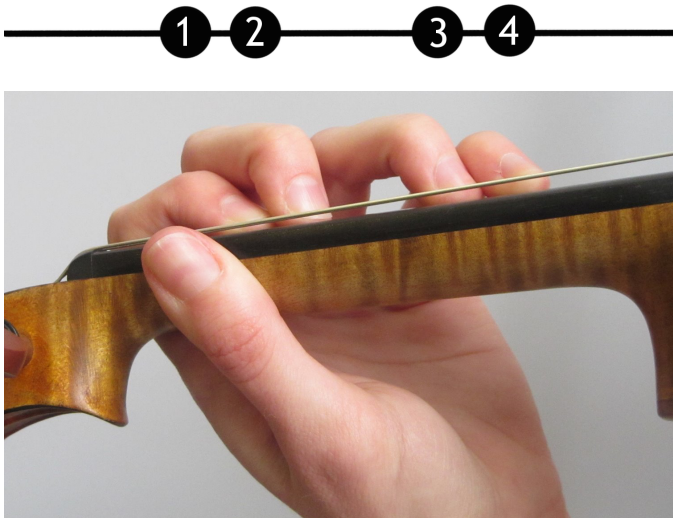
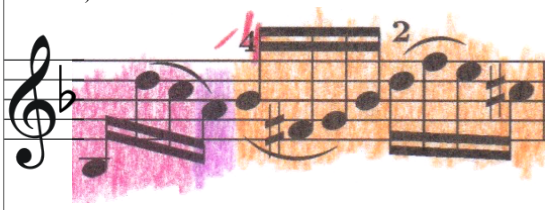
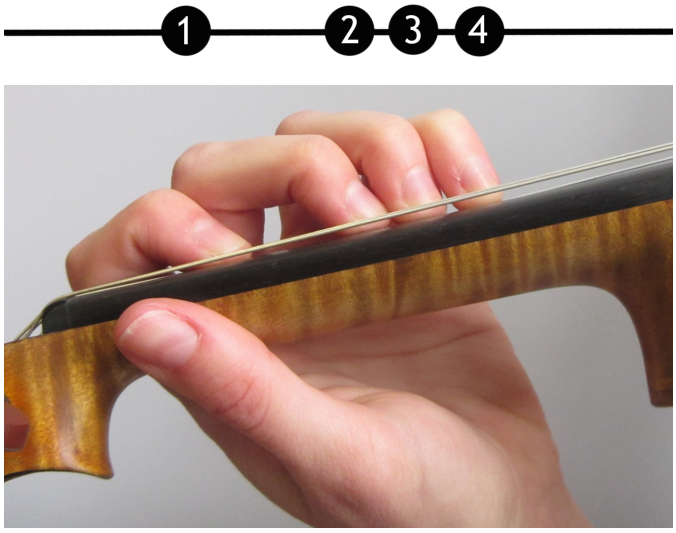
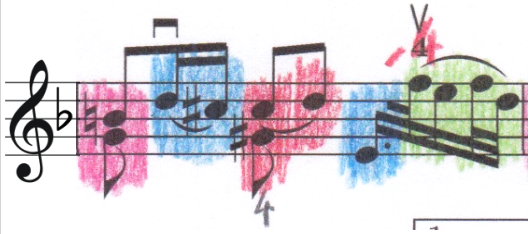
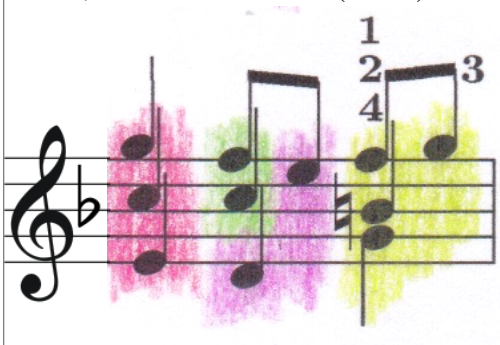
Appendix A. A Taxonomy of *Frames*.

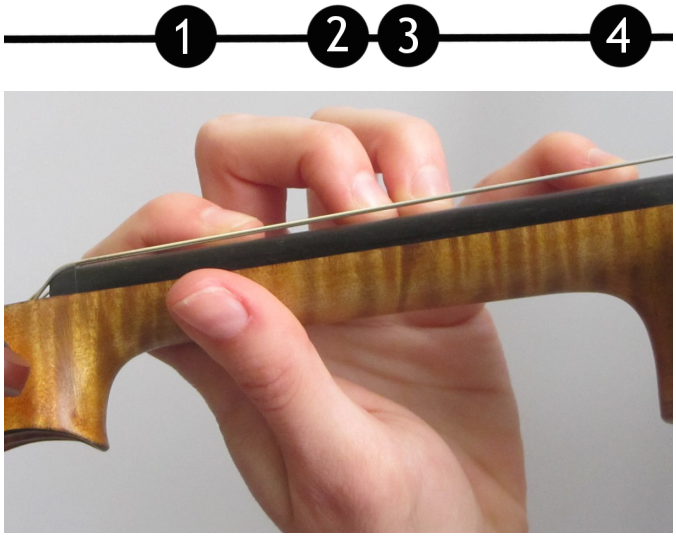
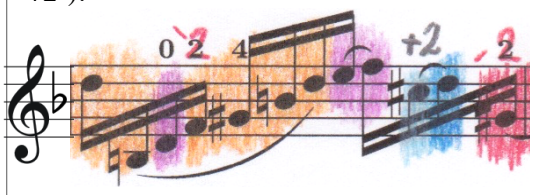
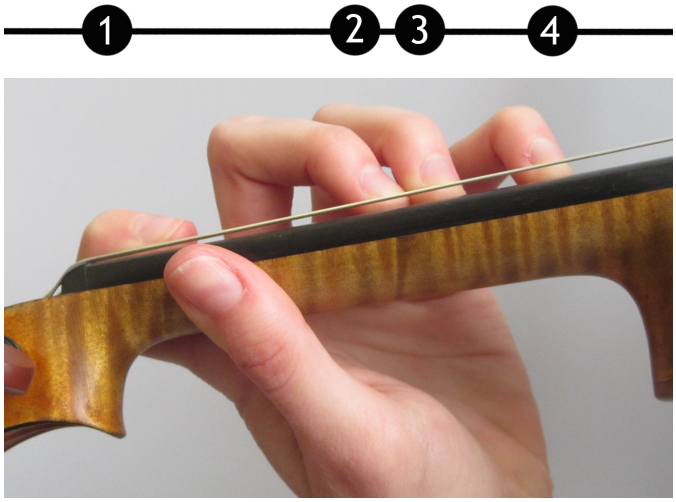
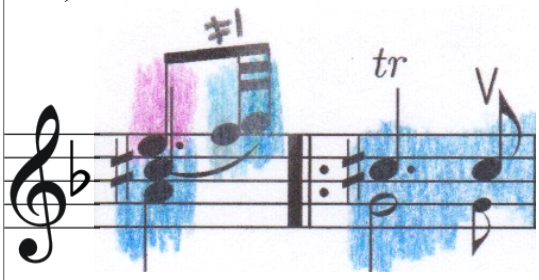
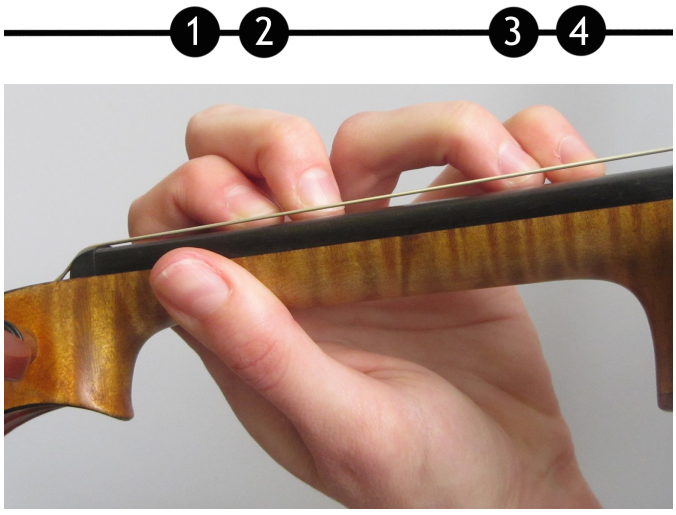
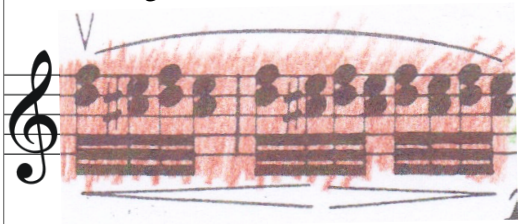
Table 6. *Frames* with Examples.[81]

Frame **(shown in first *position*)**	**Example**
Green (TTS) 	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 1. 
Blue (TST) 	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 8. 

[81] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.
Felix Bartholdy Mendelssohn, *Concerto in E minor, Opus 64, for Violin and Piano*, ed. Zino Francescatti (New York: International Music Company, n.d.), 11.

***Frame* (shown in first *position*)**	**Example**
Pink (STT)  	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 24–25. 
Purple (SSS)  	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 18.  See subchapter 2.3 for more detail.
Yellow (TTT)  	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 27. 

***Frame* (shown in first *position*)**	**Example**
Orange (STS)  	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 25. 
Red (TSS)  	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 19. 
Light Green (SST)  	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 11 (beat 3). 

***Frame* (shown in first *position*)**	**Example**
Light Blue (T+S) - 4th finger *extension* towards the bridge. 	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 26 (indicated with '+2'). 
Light Blue (T+S) - 1st finger *extension* towards the scroll. 	Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 9 (indicated with '≠1'). 
Brown (ST+SS) - a minor third interval between 2nd and 3rd finger. 	Mendelssohn, *Concerto in E Major, Op. 64, Andante*, mm. 74–75 (in 4th position, on A and D strings). 

Appendix B. *Framed* Bach Partita No. 2 in D minor for Solo Violin, Sarabande.

The following image was *framed* by the author.

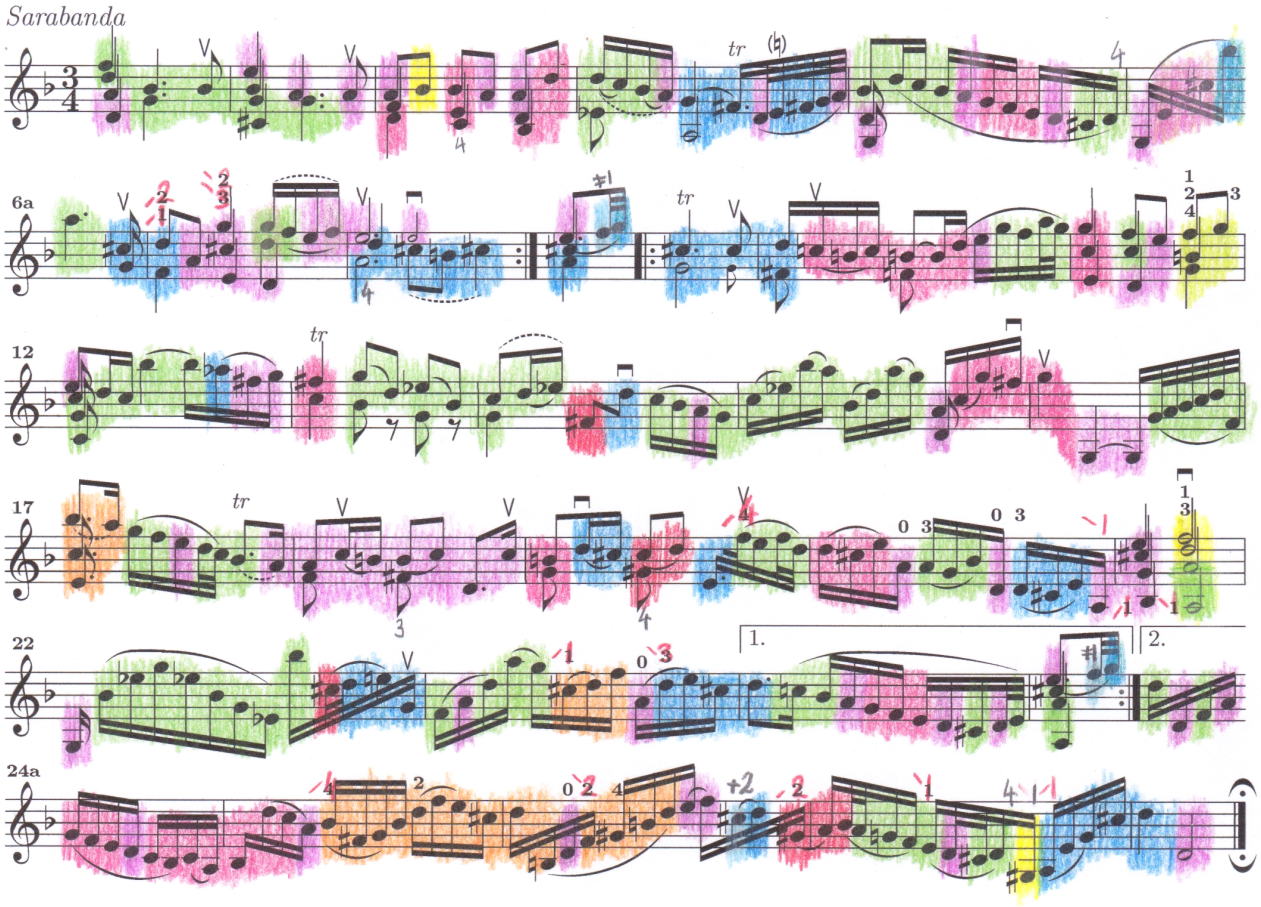


Figure 18. *Framed* piece. Bach, *Partita No. 2 in D minor for Solo Violin, Sarabande*. mm. 1–28.[82]

[82] Bach, "Partita No. 2 in D minor for Solo Violin, Sarabande," 24.

Appendix C. *Framed* excerpt from Brahms, Symphony No. 4 in E minor, op. 98, Andante Moderato.

The following image was framed by Challen in 2014.

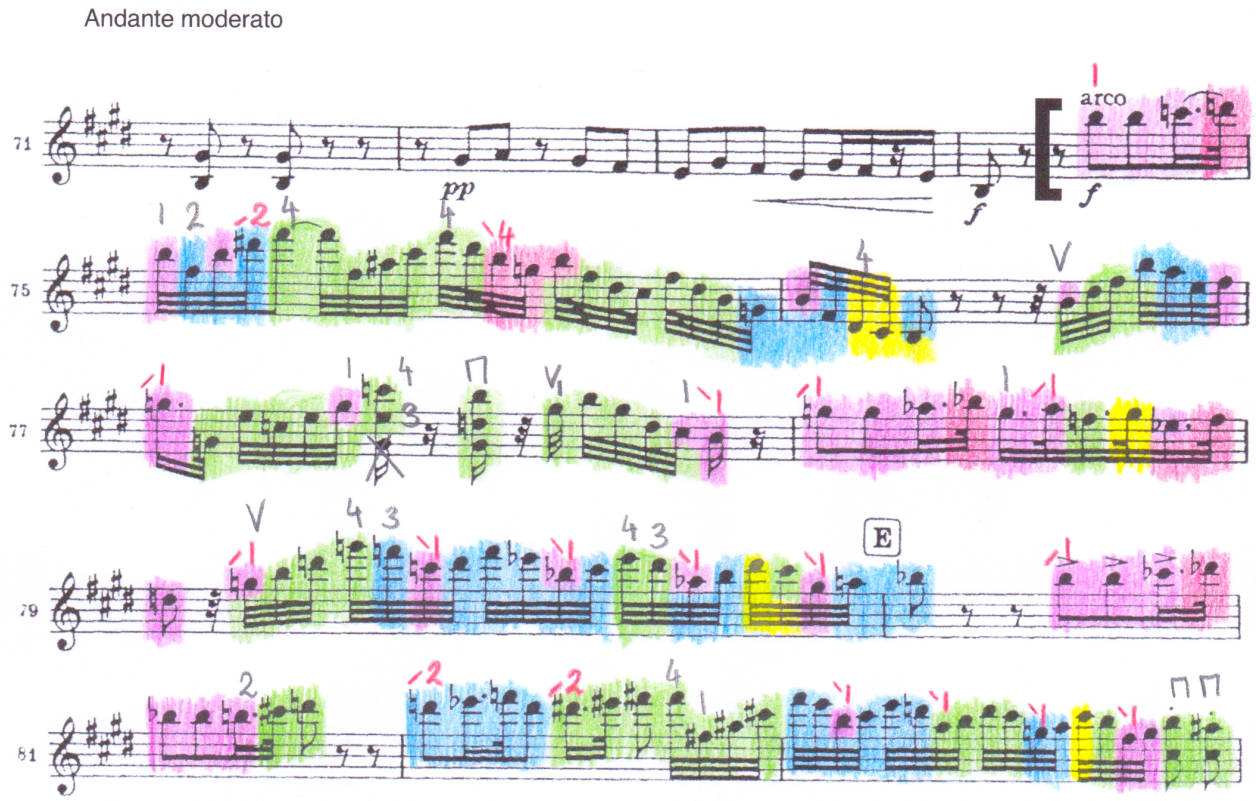


Figure 19. *Framed* piece. Brahms, *Symphony No. 4 in E minor, op. 98, Andante Moderato*. mm 74–83.[83]

[83] Image taken from the Australian Youth Orchestra violin excerpts for 2015.

Appendix D. Information Letter and Signed Consent Form.

INFORMATION LETTER TO PARTICIPANT

Title of Project: The Classification of the *Finger Frames* Method in Violin Playing: using colour association to inform accurate reading and intonation in real-time music reading.

Dear Ms Challen,

I am currently studying a Bachelor of Music Honours degree at Edith Cowan University in Perth Western Australia and would like to invite you to take part in this research project, which I am conducting as part of the requirements of my degree. The research project has ethics approval from the WAAPA/SAH Ethics Sub-Committee.

This project aims to:

- Document the *Finger Frames* method.
- Through qualitative research determine whether the *Finger Frames* method can improve intonation and accuracy in music reading.
- Address the current research on synaesthetic associations in colour notation and their use in left hand violin technique.

If you choose to take part in the project you will be invited to participate in a recorded interview detailing questions about the *Finger Frames* method and what evidence in teaching practice may suggest that such a system will improve accuracy of intonation in music reading for string players.

The interview can be conducted at a convenient location of your preference and will require 30 minutes of your time.

All information collected during the research project will be stored securely on ECU premises for five years after the project has concluded and will then be confidentially destroyed. The information will be presented in a written report. You may be sent a summary of the final report on request.

I do not anticipate any risks associated with participating in this research project.

Participation in this project is voluntary and you are free to withdraw at any time and there will be no penalty for doing so. If you would like to take part in the project, please complete, sign and return the attached consent form.

If you have any questions about the research project or require further information you may contact the following:

Student Researcher: Brittany Williams
Telephone number: +61407406095
Email: bwilli25@our.ecu.edu.au

Supervisor: Dr Stuart James
Telephone: +61416048096
Email : s.james@ecu.edu.au

If you have any concerns or complaints and wish to contact an independent person about this research project, you may contact:

Dr Matthew Styles
Chair of the WAAPA/SAH Ethics Sub-Committee
Phone: (+61 8) 9370 6065
Email: m.styles@ecu.edu.au

Thank you for your time,

Yours sincerely,

Brittany Williams

CONSENT FORM

Title of Project: The Classification of the 'Finger Frames' Method in String Playing: using colour association to inform accurate reading and intonation in real-time music reading.

- I have been provided with a letter explaining the research project and I understand the letter.
- I have been given the opportunity to ask questions and all my questions have been answered satisfactorily.
- I am aware that I can contact Dr Stuart James or Dr Matt Styles if I have any further queries, or if I have concerns or complaints. I have been given their contact details in the Information Letter.
- I understand that participating in this project will involve a recorded interview.
- I consent to having my voice recorded during this research.
- I understand that the researcher will be able to identify me.
- I am aware that the information collected during this research will be stored in a locked cabinet at ECU for 5 years after the completion of the project and will be destroyed after that time.
- I understand that I can withdraw from the research at any time without penalty.
- I freely agree to participate in this project:

NAME: FLEUR CHALLEN

SIGNATURE: Fleur Challen DATE: 10/9/16

Appendix E. Transcribed Interview with Fleur Challen.

Interviewee: Fleur Challen

Interviewer: Brittany Williams (author)

Date and Time: 10/09/2016 10:00am

Location: Perth, Western Australia

Williams: How would you explain the *Finger Frames* method to someone who has previously never encountered them?

Challen: Is this someone who previously has played the violin?

Williams: Yeah, a violinist who has never used *frames*.

Challen: Well, they're called the *frames* because they're a basically a set of frames for all four fingers of the left hand that we use in violin. It means that your fingers are always organised so whether you're playing only a 1st finger or only a 3rd finger or only a 4th finger, you're always thinking about every finger. It's come about basically because, well in my own case, through injury, to find the most optimal biomechanical way of playing, which means when you play with these *frames*, at no point are you ever under any stress or tension and it's the strongest possible way you could use all your fingers and your hand. For the extreme majority of the time, you'd never ever stretch further than a tone between two fingers. Which I think in normal violin playing, people do often. It's very well considered, you never place your finger without knowing how it fits into one of these set *frames*.

Williams: What are all the *frames* you use and what are there corresponding colours?

Challen: So we have the three basic ones; we call them Green, Blue, Pink. In fact I came up with these colours for the *frames*, on the very first day. I never modified it ever.

Williams: So it sort of sprang into existence!

Challen: Yes! And the reason Green is green is because it is simply the most natural position for the hand. So it's like Green is go, like on a traffic light. Blue is… it's not red, so it's still quite good. And Pink is a product of the highlighter colours you can buy. You can't really buy red I suppose. But Pink is sort of not the best one.

Williams: So those are the three most common *frames*?

Challen: Yes, along with Purple. But those three, Green Blue and Pink, are very important. They're like the foundstone of the whole thing, because those *frames* make either an octave if we're going from a lower string to the next string, or a fourth. It's that common thing we have to do in violin all the time and in scales. So they are the three that instantly spring to mind. And then Purple, as you know, is semitone semitone semitone. We use it even if we're only using a first finger, rather than just having the other fingers any old how. We close them all in, absolutely in, because it's a rest point. It's like relaxing the hands when you're asleep. It seems obvious, but if you observe other violinists you'll see they don't do it.

Williams: Yeah I see it in my students all the time!

Challen: And professionals! Because the 1st finger is the first finger most people learn to use.

Williams: Yes.

Challen: Not my students. If they're a beginner with me they'll learn 4th finger first.

Williams: Really?

Challen: Yes!

Williams: That's amazing!

Challen: Yes, because having learnt myself obviously, you have to start at some point, and students who've come to me don't like to use the 4th finger. They've learnt 1, 2, 3 and they don't really like 4th finger. And why don't they like it? Because they've been set up wrong.

Williams: Yeah, not with their hand closed in.

Challen: That's right. 1st finger, because it's easy, you can put it down any old way, so people don't put it down correctly.

Williams: And that causes problems later on.

Challen: Yes. So if you start from the 4th finger and then work backwards, say backwards from Green, then there's no other way to put the 1st finger down other than correctly.

Williams: Yeah.

Challen: So even if I was starting a piece, let's say that started with B on the A string, I would already set up the whole Green *frame*, from the 4th finger backwards, and then take the fingers off, silently before I even start, and then going to Purple, for that one 1st finger B.

Williams: Was there a specific piece that inspired to create the *frames*?

Challen: Praeludium and Allegro. Because I had a student, who will remain nameless, who could play it really well, and in the next lesson, maybe two days later, it was like we'd never played it ever. Gone from playing it fantastically to nothing and I was tearing my hair out. So there's been two reasons why I came up with them, one of them was for physical reasons. And I noticed that for myself, I could play so much better, even than I could prior to any injury. And also I know that all of my students, who are not injured, they play with a sound that is so much better than everyone that I know. In fact, everybody sounds the same, in a good way. Not like they're clones, it's just that there's this centre to the sound, to every note they play. So this is something they do, they're not injured, but this is how I teach and I wouldn't ever actually teach anyone ever without introducing them. Even if it's only for a short time, it would be easier.

But the piece, with this student, she was a good player and very musical and all that, but not very diligent shall we say, with her practice. I would be so frustrated that we would come to the next lesson and it was like we never did this. So I was tearing my hair out and I just thought, I have to find a way for her to somehow retain what we've just been doing. Originally I didn't have the colours, originally it was the tone tone semitone, tone semitone tone.

Williams: So you'd write that in?

Challen: Write it in yes. STT or TST. And that was good, I mean that was the start of it. But it takes time. It's not like instantly that you can just see it.

Williams: You've got to process each tone and semitone.

Challen: That's right. And then eventually I just came up with the colours as I said, which I've never changed, apart from one *frame* which is a very rare one and we just use whatever colour anyone has in their house.

Williams: Which *frame* is that?

Challen: That's the T plus S.

Williams: Oh yeah, okay.

Challen: It's more than a tone.

Williams: Yeah, and I have a Brown *frame* where it's semitone, and then tone plus a semitone, like a minor 3rd. It's Orange with a minor 3rd in the middle.

Challen: Yes something like that. We have these other ones that are so rare, and they can be any colour, whatever you choose, because they happen so rarely. Because that's the thing, no matter how complicated something looks, and I know this as someone who performs a whole different program every single week in WASO, I know that the *frames* cover everything. Wagner, Richard Strauss, Mahler, everything. It's incredible actually, because you would think maybe it only covers those simple little pieces that you learn to start with, but no. But when someone is doing a Suzuki book 1 or something, they're very good at Blue, but they don't like to play Green. But Green is the easiest *frame* actually. It's just that they are used to playing Blue. They don't know they've been playing Blue but all their pieces have been in the Blue *frame*.

So this bit in Praeludium and Allegro, when you look at it on the page, it's looks a bit difficult. Then when it was *framed*, you didn't have to work out TTS or TST. I mean it's useful to learn it, but it's not quick. But obviously when I look at music in orchestra obviously I can't put colours in my music! But in my mind I can. So instead of all those individual notes, I just see big blocks of things that are set. And it's not only helpful to know what the notes are, but it means that you're setting your hand up properly to actually play all those notes.

Williams: So when you first came up with the colours, prior to that were you already thinking in *frames*?

Challen: Not too much I think. But when I came up with the TST I did think about it then.

Williams: And then how long after you came up with the colours did you start to automatically see them on the page?

Challen: Probably took me a while. Now I can do it so easily without having to think, but for a while I maybe had to play a bit and then put it [the colours] in.

Williams: But now you can just kind of see it?

Challen: Yeah, I see it instantly. As I've seen with Prokofiev [Romeo and Juliet], without any work in between from the last time I did it, to now, it's like I'm totally on it.

Williams: It's like you flipped a switch and suddenly your brain is working in a different way!

Challen: Yes! And you know when we did our lessons, and with lots of my students, we will spend a lot of time putting colours and things in and some of them I still do. But most of them who've been learning with me a little while now, we don't bother. Because they already see it. And that's the fantastic thing, especially if they're sight-reading, in orchestra or for an audition.

Williams: So you would say that it's really beneficial in sight-reading?

Challen: Absolutely! Especially if, say instead of a C major scale, you have a C# major scale, or something like that. Well that could look difficult on the page. But if you just see it as Green, the whole thing Green, one semitone up from C natural, you can play it perfectly.

Williams: Yeah! In my dissertation I'm talking a lot about how, well for me personally, I find it really helps with sight-reading, or if I'm doing excerpts or things I need to learn really quickly. Do you think that it's beneficial for learning things quick?

Challen: Totally. I mean I couldn't imagine playing without them. Even if you could play all the notes, first of all it would take longer learn them, without doubt. But also, it wouldn't sound as good. Because when you play in *frames*, because you're never stretching further than a tone, you're always right on top of note.

Williams: So in that way it would help with intonation as well?

Challen: Absolutely! And sound quality! If, say you play say a 1st to 2nd a tone apart, or set up the whole Blue *frame* and then play, you'll find even though you weren't really out of tune, you were playing the right notes before, if you play with a *frame* you'll find you get a totally different sound. And you couldn't say that you even moved the finger, it's just not really focused, like if you had set up the entire hand.

Williams: So when you were using Praeludium and Allegro, when you were going from writing out tones and semitones to the colours, did you start out with the main colours, Green, Blue, Pink and Purple and then add the others? Or did it all come together at the beginning?

Challen: So that's like the very starting stage, so I'd probably have to play it again to be honest.

Williams: As a new *frame* came along would you assign it a colour, just as you were going through the piece?

Challen: Eventually, and I think they've developed more, because I've become more specific about them as time's gone on. Like more specific about using Purple. Purple on 1st finger is like a really important thing, it's like a pivot note that you can get out of trouble. But I think in that particular passage as far as I recall, to start with it's Pink, Green, Green, and so on. They were mostly all the standard ones. But if I was to do it again, maybe I would be more particular about how I could even refine it more. But at that time, that was good enough.

Williams: Just on that, I've *framed* certain things and then I'll go to you and then you change them slightly, would you say that Framing things can be kind of subjective?

Challen: Yeah definitely.

Williams: Sometimes one person might do something one way, and then you might have like a different way of doing it.

Challen: Exactly. I say this to my students. In my mind this is how I would do it. But that may be a bit confusing to a student, so they might prefer just to keep something all as Green, rather than Blue, Green. Or Purple, Pink, rather than just straight Pink. Or even more complex than that actually. I might do a half and half on one note where we started in one *frame* and then midway through the note change it. Like a getting there *frame* and moving on *frame*.

Williams: And sometimes there'll be this kind of example, where something would be Pink, but I know there's Orange coming up, so sometimes I'll just think of it as Orange.

Challen: That's good! Yes!

Williams: Whereas some of my students would prefer to just think of that as Pink because it's easier.

Challen: It just depends on the student and their level. And that's the funny thing because passages that require Orange are generally ones that people break down on. But it's so strong because you're not stretching at all when you play Orange. It's much easier that Green or Blue or Pink. Although mentally just thinking of it as Blue, Green and Pink is easier, and maybe Orange is a little unusual, but physically it's a nice one. But you're right, I always like to think of a normal *frame*, one of the Pink, Blue and Green ones, even if you're only using two fingers.

Williams: Yeah like the first two fingers of Blue kind of look like Red.

Challen: Yes that's right, because that would just be far too complicated. We know it's Blue, but we also know it's better to close in the hand.

Williams: When did you come up with the *frames*? How long have you been working on this?

Challen: Gosh, about five years ago I think. And this is the interesting thing, it's like a constant thing that I'm refining all the time.

Williams: There are actually a couple of things that I do that you didn't tell me to do but I just sort of added in.

Challen: Yeah what you showed me in your proposal.

Williams: Yeah. So when we're using the Light Blue *frame*, which can be used for *extensions*, I know you use a little plus symbol for when you're extending.

Challen: Oh yes yes.

Williams: So if I'm extending towards the bridge I obviously use your little plus. But if I'm extending back with my 1st finger I use like this little inequality symbol. Because a minus symbol can like kind of look like a shift. I actually came across the symbol in an old Galamian method book and I found that he actually uses it for backwards *extensions*.

Challen: This is the thing, whatever works best for the person doing it. Within reason, we can't just change the whole thing. Keep the basic things and then there can be like little things that suit people a bit better.

Williams: And also the other thing that I do, is when you're doing an *extension*, you might extend a minor 3rd or a major 3rd, but you probably wouldn't go further than that.

Challen: Well actually this is a good point. I don't really extend.

Williams: You don't really extend?

Challen: No. And I grew up doing a lot of *extensions* and my teacher was really into them. But I'll tell you why I don't do them. You can still do the same fingering, just don't extend. You do a little semitone *shift* with the 1st finger.

Williams: Oh okay!

Challen: So you stay in a *frame*. See I never want to be out of a *frame*. Unless it's like a Paganini Caprice and there's no other alternative, which sometimes happens, like in No. 1.

Williams: So now when I see my notation for an *extension*, I'll start thinking of it as a tiny *shift*.

Challen: Always always! But nobody would be able to see it. It won't be an obvious *shift*, like it wouldn't be 1st finger to 1st finger. It's two things together: a small *shift* of a semitone, not necessarily on the 1st finger, plus changing the *frame*. That is still like 'creeping' but even better than 'creeping', because any time you extend you're still within a *frame*.

Williams: Yeah, So you *shift* like a little semitone, if I wanted to go back say a major 3rd, could I *shift* like a tone?

Challen: Oh yeah definitely!

Williams: So you've said that you've developed it a little bit more and refined it, what have you actually added to it?

Challen: I think I've added more Purple. Originally it was more for a mental thing, for people to be able to process the notes. And as people have become very used to it, it's become very normal for them to think along those lines, so we get far more specific. We might change them more frequently, in a short space, within a phrase, to make every note more strong or beautiful or more perfect.

Williams: So instead of doing what's easier for the student, like having all Green in a line or something, there might be something in there, that if you change it sounds so much better.

Challen: Yeah that's right.

Williams: Would you introduce *frames* as soon as you start teaching someone?

Challen: Of course, I wouldn't even consider not.

Williams: You know when you always get students where they've been taught a certain frame, like they've been taught Blue, but they're fingers are never quite close enough together.

Challen: Oh we just start completely again. This is an important thing, all the fingers have to be able to land simultaneously, because when you look at the hand, this is where the two big problems come in violin playing I think. Uneven strength, and bad intonation, obviously. And I think that comes from, when you look at the hand all the fingers are different lengths, so you have to

accommodate that, and that's what I think the *frames* do, apart from many other things. You need to be able to practice open, Blue, open, Pink, open, Green. You must be able to get these fingers down simultaneously.

Williams: Yeah. And get them down simultaneously in tune, not just doing some kind of parody of Green.

Challen: Yes, absolutely. They actually all have to be down properly. And this is a big thing with me I'm always saying 'oh you've got that dreaded long 3rd finger!'

Williams: And 3rd is the worst as well because it's connected to these two fingers [2nd and 4th].

Challen: I know! And people don't take proper care of it so it's not strong, and you can just lift it up easily. So everything has to come down together.

Williams: And if it's like that would you say that as a general rule everything is going to be way more in tune?

Challen: Oh definitely! There's absolutely no doubt, because I think the whole reason everything else generally is pretty out of tune in most kids, is that with the best will in the world, even with good ears, their hand is not organised. They might be trying really hard, but they can't do it, because they've got 1, 2 and then they've got this long 3rd finger, which is not going to go where it's supposed to go.

Williams: And then they get stuck there with their long 3rd finger and then they've got this little 4 which now can't reach at all.

Challen: Yes, exactly. And the 4 is shorter in the first place. But as you know, or may not know, my 4th finger is injured, it's kind of half broken.

Williams: Oh my goodness!

Challen: Did you not know this?

Williams: No I didn't know that!

Challen: See you'd never know, because to look at me to play you wouldn't know.

Williams: Yeah you wouldn't notice at all!

Challen: Yeah it's called Boutonniere's deformity. This snapped here and this tendon is running down the wrong spot. But to look at me playing you wouldn't even know. Because I use my

fingers in combination. I can't use that finger by itself actually, the 4th finger. But it is very effective and appears strong as a result of the *frames* despite the injury.

Williams: Is that like why you'd say that Green and Orange are really strong, because the fingers are supporting each other?

Challen: Yeah exactly right! I have had in the past, students who have said 'Oh I can't do that, because my 4th finger is not that good,' or 'my 4th finger is little,' or whatever. And I wasn't very happy when this happened, it was a big snap, and it hurt like hell, and I was going to have an operation on it. But in the end we decided, since I could play, to leave it alone. Because the treatment for it is to splint it or operate or do something, and because I'd worked out a way of playing it was best to just leave it. So once I got over the upset of that happening to me, I see it as a blessing, because no student can tell me that they can't do this and that with their 4th finger, because mines the worst!

Williams: I'm going to jump to the questions on my additional research. So in my dissertation I'm talking about your method, and then I'm talking about some psychological theories and how that might apply to *frames*. I've done some research into artificial synaesthesia, and when people who don't have synaesthesia try and learn to create associations between colours and information, I think that's similar what we're doing, we're associating a *frame*, which is the information, with a colour.

Challen: Yeah the instant we see the colour we perform the *frame*.

Williams: And I've found in my research that this kind of artificial synaesthesia creates really fast reaction times. Do you think you see this in *frames*?

Challen: Yes! Because what we were saying, about when it used to be TST, or TSS, and that was one thing, it was good, but slow, you had to work it out.

Williams: And then the next thing sort of ties in with that as well. I've been looking at Cognitive Load Theory, which is the idea that the brain can deal with a certain amount of information, and then if you put more information in, the brain can't cope and it's just too much. The theory says that some tasks, by nature, are just difficult because they have a lot of parts to them, so that's kind

of like by writing in TST you're adding more parts, and they say the only way to bring down the cognitive load of these things is to change the way the task is presented.

Challen: Perfect!!

Williams: I just can't help thinking that the *Finger Frames* method is just like that, we're just changing the way you present sheet music, by putting colour on it.

Challen: Yeah it reduces lots of stuff, into just the colours.

Williams: And you're not trying to deal with each individual piece of information. You're putting it all together.

Challen: That's right!

Williams: So would you say that in using coloured *frames*, you're dealing with less information in a way?

Challen: Totally! I never feel stressed. Even if I feel like we've got a very difficult program, I don't think I'll never be able do it, which is I think how a lot of us and a lot of people feel, and how I might have felt in the past. I never feel overwhelmed. Because if you can do Pink, Green, Blue and Purple, you can do anything. It's actually mathematical. Adding those *frames*, and occasionally Yellow or maybe Orange and the odd Brown or whatever you want to call it, but basically the main ones will cover most things. And then when you get Orange it's actually good because it's something you can do really easily.

Williams: I always find that Orange is strong because each finger is supporting another other.

Challen: Yeah exactly right. So you have that, but it's two elements; the *frames*, plus knowing where you're *shifting* from and to, and with what finger. So it's mathematical.

Williams: And without that mathematical stuff…

Challen: You can't get the emotion. So by being mathematical, you can actually then be free to put all the music into it. But when you're just like struggling and and desperately grasping at notes…

Williams: There's no room to put actual music into it.

Challen: You know in the past you'd have to practice scales and thirds, well we don't have to do that anymore, because that's how we play every single note. And so you come to play a sixth or a third

or an octave and it's no issue. You're literally practicing all those things constantly. And it's not a cheat, you're still doing it! It's just you've put more thought into it.

Williams: It's just that you're changing the way that your brain is processing things.

Challen: Yeah, and it's like four times faster. At least. Because you've always got four fingers down. But probably more than four times faster. And this is an important thing to note. This is not a Suzuki A2 and E1 and things like that. It's nothing like that. This is in additional to normal notation, this is thinking on a much higher level, not on a lower level. It's thinking more. It does make it easier, in the end, but you are thinking more. You're seeing all the invisible notes that aren't in the music, because you're thinking in so much more detail than most people. And couldn't do this if you couldn't read music.

Williams: Yeah. We're going into more detail, but our associations are so quick that it makes faster. What do your colleagues think of the *frames*, because I imagine you get a lot of different reactions?

Challen: I don't talk to them about it. It's not like I keep it a secret. I only talk more to people who are not violinists. They'd probably think I was a lunatic I think, the other violinists.

Williams: Do you find that some students respond better to *frames* than others?

Challen: Most of them respond extremely well. But I have one student who will do them, but not until I insist on it.

Williams: Okay, yeah. Because I've had one student who is just a little bit resistant.

Challen: But I think we should probably consider those students an exception to the rule. Because apart from that I would say everyone, including people that I've only had for a week or so, there's not a single case where you can say that it would be a negative thing to do the *frames*. And not only would it not be negative, there wouldn't a case where it would make no difference.

Williams: This is kind of a little bit off topic, but I will still colour things because I don't think I'm at the point yet where I can just look at my music and see the colours.

Challen: Well that's fair enough, because you don't sight read as much as I do!

Williams: I think I've pretty much covered every question, so if there's anything else you want to add…

Challen: Well I might think of them later as I'm playing the ballet tonight or something, but I think we pretty much did cover everything.

Williams: I think we've got a good broad sort of look at it.

Challen: Yeah for sure.

Williams: Thank you so much!